School Board of the City of Staunton Shelburne Middle School Additions and Renovations

PROJECT MANUAL

CRA PROJECT NO. 3636

February 5, 2024

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Charlottesville, VA • Baltimore, MD • White Sulphur Springs, WV

VOLUME 1

PROJECT MANUAL

FOR

SHELBURNE MIDDLE SCHOOL
ADDITIONS AND RENOVATIONS

FOR THE
School Board of the City of Staunton, Virginia
116 W Beverley St
Staunton, VA

CRABTREE, ROHRBAUGH & ASSOCIATES
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ARCHITECT'S PROJECT NO. 3636

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SECTION 000010 ADVERTISEMENT FOR BIDS

NOTICE

Notice is hereby given that sealed bids for construction of Shelburne Middle School Additions and Renovations located at, 300 Grubert Ave Staunton, VA will be received at the Finance Offices of the School Board of Staunton City, VA – 116 W. Beverley St,3rd Floor Finance, Staunton, VA 24401 until **2:00 P.M., prevailing time**, **on March 12, 2024.** Bids may also be overnighted to the above address. Bids must be submitted to the **attention of Chad Horvat, Finance Business Manager**. Bids shall be submitted in sealed envelopes bearing the name of the Bidder and shall be clearly marked "Shelburne MS Additions and Renovations". Bids will be publicly opened and read aloud immediately after the scheduled closing time for receipt of Bids. Bids received after the above-referenced date and time shall be returned to the Bidder unopened.

Separate, sealed Bids will be received for the following Prime

Contract: 3636-1 General Construction

On or after Tuesday February 6, 2024 Bidders may obtain bidding documents in .pdf electronic format from the City of Staunton website https://www.ci.staunton.va.us/departments/finance/procurement and at the Virginia State Procurement site (eVA) https://mvendor.cgieva.com/Vendor/public/AllOpportunities.

All questions pertaining to the Contract Documents, technical sections, legal documents, and bid submission shall be directed in writing to: Joshua C. Bower, Sr. Project Manager, phone number (434) 975 7262; email: jbower@cra-architects.com.

Each bid shall be accompanied by bid security in an amount equal to five percent (5%) of the Base Bid amount and all alternate bid amounts in the form of a Bid Bond as described in the Supplementary Instructions to Bidders.

A Performance Bond and a Payment Bond in the forms provided in the Project Manual, each in an amount equal to one hundred percent (100%) of the amount of the Contract, and each with satisfactory corporate surety, must be furnished by the successful Bidder prior to execution of a Contract.

Bids may not be modified, withdrawn or cancelled by the Bidder for sixty (60) calendar days following the actual date of opening thereof. However, if award of Contract is delayed by the required approval of another government agency, the sale of bonds or the award of a grant or grants, Bids may not be withdrawn by the Bidder for a period not to exceed 120 days from the date of bid opening.

Staunton City Schools reserves the right in its sole discretion to reject any or all Bids and to waive irregularities in any Bid. Further, Staunton City Schools reserves the right to award any combination of Alternates, or no Alternates, which in its sole discretion, serves the best interests of the School Division.

A non-mandatory Pre-Bid Conference will be held on **February 15, 2024 at 4:00 PM,** prevailing time, at the Shelburne Middle School located at, 300 Grubert Ave Staunton, VA. This conference will be conducted by the Architect with a description of the project and walkthrough of the building.

A second non-mandatory Pre-Bid Conference will be held on **February 22, 2024 at 4:00 PM,** prevailing time, at the Shelburne Middle School located at, 300 Grubert Ave Staunton, VA. This conference will be conducted by the Architect with a description of the project and walkthrough of the building.

No additional walkthroughs will be offered to Contractors outside of the two Pre-Bid Conferences.

All questions are due by February 23, 2024. Final addendum shall be issued by February 28, 2024.

END OF SECTION 000010

AIA® Document A701™ – 2018

Instructions to Bidders

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

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

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

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

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

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

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

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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.)

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§ 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.)

§ 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.

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§ 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.)

§ 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.

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

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

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 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.)

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.

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

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

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

ARTICLE 6 POST-BID INFORMATION
§ 6.1 Contractor's Qualification Statement
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability
A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

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

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND
§ 7.1 Bond Requirements
§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

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

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

.5 Drawings

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Number	Title	Date	

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

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

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

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SECTION 000101 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

Section 000101, Supplementary Instructions to Bidders, contains modifications to the basic document, **AIA Document A701, Instructions to Bidders, 2018 Edition**, in the form of additions, deletions and substitutions. Where any part of the basic document is so modified by these Supplementary Instructions, the unaltered provisions shall remain in effect. These Supplementary Instructions constitute part of the Bidding Requirements.

AIA Document A701, as modified herein, constitutes an invitation to bid on the Project pursuant to the provisions of Section 2.2-4302.1 of the Code of Virginia, and the other provisions of the Virginia Public Procurement Act (Virginia Code 2.2-4300 *et seq.*) (the "VPPA"). This solicitation is subject to all applicable terms of the VPPA. By submitting a bid in response to this solicitation, Bidders agree to all the provisions of these Bidding Documents.

The Owner does not discriminate against faith-based organizations in accordance with the Code of Virginia, section 2.2-4343.1 or against an Offeror because of race, religion, color, sex, national origin, age, disability, sexual orientation, gender, gender identity, political affiliation, veteran status, marital status, pregnancy, childbirth or related medical conditions, or any other basis prohibited by state law relating to discrimination in employment.

ARTICLE 1 - DEFINITIONS

DELETE the last sentence of Paragraph 1.1 and SUBSTITUTE the following:

[Substitute]: The Proposed Contract Documents are the documents described as "Contract Documents" in Subparagraph 1.1.1 of Section 000750.

DELETE Paragraph 1.2 in its entirety and, in lieu thereof, SUBSTITUTE the following new Paragraph:

1.2 Except as provided for herein, all definitions set forth in the Conditions of the Contract (General, Supplementary and other conditions) or in other Contract documents are applicable to the bidding documents.

ADD the following new Subparagraph as follows:

1.2.1 The following words are intended to mean:

- Furnish (Materials): To supply and deliver to the project ready for installation and in operable condition.
- Install (Services or Labor): To place in final position, complete, anchored, connected and in operable condition.
- Provide: To furnish and install complete. When neither furnish, install nor provide is stated, provide is implied.

ADD the following to the end of Paragraph 1.4

[*Add:*] "and applicable law."

ADD the following to the end of Paragraph 1.8

[*Add:*] "and applicable law."

ARTICLE 2 – BIDDER'S REPRESENTATIONS

ADD new Paragraph 2.2 as follows:

2.2 The Bidder is required to examine carefully in detail the character of the site of the Project, the Contract Documents and all other matters pertinent to the work contemplated. By submitting a bid, the Bidder expressly represents that it has satisfied itself as to the conditions to be encountered, including conditions that are overhead, on the surface and concealed, the character, quality and quantities of work to be done and materials to be furnished, and the requirements of the Contract and Specifications. No allowance or concession will be made for the lack of such information. Where underground and overhead structure locations are shown, they are for the information of the Architect only; their correctness is not guaranteed or warranted by the Owner or the Architect, and in no event is this information to be considered a part of the Contract Documents, or to be relied upon in preparing the Bid. If this information is used by the Bidder in preparing its Bid, the Bidder must assume all risks resulting from conditions differing from those shown in the information provided. Test Boring Information concerning subsurface materials or conditions which are based upon test pits or test borings has been obtained by the Owner for the Architect's use in designing the Project. This information is available to the Bidder for information only. References to this information may be found in the Table of Contents. The technical data found in the test boring information is represented to be accurate by the Owner, but the conclusions and inferences that may be found in or inferred from the information is not warranted, and the accuracy or completeness of any such conclusions and inferences is not guaranteed by the Owner or the Architect. By submitting a bid, the Bidder represents that it has not relied upon the subsurface information supplied by the Architect or Owner and assumes all responsibility in excavating for this project for any and all subsurface conditions encountered.

The Owner will, to the extent possible, afford the Bidder the opportunity at the Bidder's own expense, to make additional borings or soundings, to drive test piles, to dig test pits on the site of the Work, and to make measurements and studies of all kinds.

There is no expressed or implied agreement that the existing conditions have been correctly indicated and bidders shall take into account that conditions affecting the cost or quantities of work to be done may differ from those indicated.

The Bidder shall carefully examine all Bidding Documents and materials pertinent thereto, with respect to all the categories of work for which the Owner has advertised and will

receive bids, so that it is completely aware and satisfied as to the character, quality and quantities of all work, materials and for services required or to be provided by the Bidder to perform and complete all work of its Contract on the Project. Further, the Bidder shall have carefully examined the tentative construction schedule for the work and by submission of a bid, represents that the time set forth for such work is sufficient for the Bidder to complete its work.

The Bidder, by submission of its Bid, represents that it has visited the site, that it has read the Bidding Documents and understands their full character and intent, that it otherwise complied with the provisions of Article 3, and should the Owner subsequently accept its Bid, no claims, allowances or concessions will be made, accepted or recognized by the Owner at any future time for any additional labor, equipment or materials required, or for any difficulties encountered in the Work, or for the lack of any information which could have been foreseen, apparent or ascertained had the Bidder so complied with Article 3.

The Bidder shall ascertain all governmental and utility requirements with respect to wage scales, materials, labor, safety and sanitation and shall base its bid prices on full compliance therewith. **Specifically, this Project is subject to the Davis-Bacon Act; see Section 000515, Page 8, Item 4.**

The Bidder has familiarized itself with labor conditions which might affect or influence the performance of the Work.

ARTICLE 3 - BIDDING DOCUMENTS

Paragraph 3.1 - Copies:
Subparagraph 3.1.1

DELETE Subparagraph 3.1.1 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.1.1 Bidders may obtain complete sets of Bidding Documents from Crabtree, Rohrbaugh & Associates as stated in the Advertisement for Bids for the fee stated therein. The fee for Bidding Documents is **non-refundable**.

DELETE Subparagraph 3.1.2 in its entirety.

ADD new Sub-subparagraph 3.1.5.1 as follows:

3.1.5.1 The Bidder agrees that all work product produced by the Architect or its consultants are “Instruments of Service” a defined in AIA Document A201™-2007, General Conditions of the Contract for Construction. “Instruments of Service” include, without limitation, representations, in any medium of expression, of the tangible and intangible creative work performed by the Architect and the Architect’s consultants under their respective professional service agreements.

The Bidder agrees that for the purposes of the bid process, the Architect is the

copyright owner of such Instruments of Service and retains all common law, statutory and other reserved rights, including copyrights. Distribution of Instruments of Service to potential bidders is not to be construed as publication in derogation of the reserved rights of the Architect and the Architect's consultants.

The Architect grants to the Bidder a nonexclusive, revocable license to use the Architect's Instruments of Service solely and exclusively for purposes of developing the Bidder's bid, including securing information or bids from the Bidder's material or equipment suppliers, contractors, or subcontractors. The license granted under this section permits the Bidder or the Bidder's contractors, subcontractors, sub-subcontractors, and suppliers to reproduce applicable portions of the Instruments of Service solely and exclusively for use in developing its bid for the Project. If the Bidder is for any reason not awarded the Contract for the Project, the license granted in this section shall immediately terminate.

The Bidder acknowledges that it shall not use the Instruments of Service for any purpose other than to prepare a bid. The Instruments of Service shall not be used as construction drawings or for any specification involved in the construction of the Project. The Bidder, for itself, and the Bidder's contractors, subcontractors, sub-subcontractors, and suppliers, hereby releases and holds the Architect and Architect's consultant(s) harmless from all claims and causes of action arising from any use of the Instruments of Service. The Bidder, to the extent permitted by law, further agrees to defend, indemnify and hold harmless the Architect and its consultants from all costs and expenses, including the cost of defense, related to claims and causes of action asserted by any third person or entity to the extent such costs and expenses arise from the Bidder's use of the Instruments of Service under this section.

Except for the licenses granted in this section, no other license or right shall be deemed granted or implied under this Agreement. The Bidder shall not assign, delegate, sublicense, pledge or otherwise transfer any license granted herein to another party without the prior written agreement of the Architect. Any unauthorized use or reproduction of the Instruments of Service shall be at the Bidder's sole risk and without liability to the Architect and the Architect's consultants, and subject to Architect's rights and remedies for infringement of Architect's rights, including without limitation, copyrights

Paragraph 3.2 – Modification or Interpretation of Bidding Documents:
Subparagraph 3.2.2

ADD the following new sentences to the end of Subparagraph 3.2.2:

3.2.2 [*Add:*] "Provided, however, that the Owner may, in its discretion, waive the provisions of the preceding sentence and reply to such a request that is not timely received. All requests for clarification or interpretation shall be made by a Prime Bidder and shall be in writing. Any request made by any other entity will not be addressed. Any request for clarification or interpretation via means other than in writing will not be addressed. Written requests will not be responded to, directly back to the Bidder. If the inquiry requires clarification to, or modification of the Contract Documents, they will be issued

via Addendum. If clarification to, or modification of the Contract Documents is not required by the inquiry, the request will not be addressed. Failure to request such clarification is a waiver to any claim by the Bidder for expense made necessary by reason of later interpretation of the ITB documents by the Owner."

Paragraph 3.3 – Substitutions:

DELETE Subparagraph 3.3.2 in its entirety, including all sub-subparagraphs and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.3.2. **Pre-bid substitutions will not be considered**. Following the award of a contract, substitutions proposed by the awarded contractor will be considered in accordance with Division 1 Section "Substitutions".

DELETE Subparagraph 3.3.3. in its entirety.

DELETE Subparagraph 3.3.4 in its entirety.

DELETE Subparagraph 3.3.5 in its entirety.

Paragraph 3.4 - Addenda:

ADD new Sub-subparagraph 3.4.1.1 as follows:

3.4.1.1 Clarifications to the Bidding Documents will only be made in writing, by Addenda. Oral statements may not be relied upon and will not be binding or have any legal effect.

DELETE Subparagraph 3.4.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.4.3 Addenda will be issued no later than two 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.

DELETE Subparagraph 3.4.4 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.4.4 The Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge, where indicated on the Bid Form, their receipt. Failure of the Bidder to receive any Addenda as provided for herein shall not release such bidder from the obligation of their Bid.

Paragraph 3.5 – The Contract

ADD a new paragraph 3.5 and associated subparagraphs as follows:

3.5 The Contract

3.5.1 A Bidder's submission of a bid signifies a bidder's willingness to enter into a binding legal contract with the terms contained in the Proposed Contract Documents that are part of the Bidding Documents, and at the price contained in the bid. Bidders may not vary the terms of the Proposed Contract Documents, which the Owner may alter only through Addendum, and may not take exception in their bids to the terms of the Proposed Contract Documents. Any exception to the Proposed Contract Documents may be cause for the Owner to deem a Bidder's bid non-responsive.

3.5.2 As a precondition to its acceptance of the lowest responsible bid, the Owner may, in its sole discretion, request that the Bidder withdraw or modify non responsive portions of a bid/proposal, which do not affect quality, quantity, price or delivery schedule.

ARTICLE 4 - BIDDING PROCEDURES

Paragraph 4.1 - Preparation of Bids:

ADD the following new sentences to the end of Subparagraph 4.1.1:

4.1.1 [*Add:*] "Attention is directed to the Bid Form bound in the Project Manual. This form is for the information and convenience of the Bidder and is not to be detached from the Project Manual, or filled out or executed. A separate copy of the Bid Form is furnished with the Bidding Documents. Complete two (2) separate copies of the Bid Form and accompanying documents, execute and submit as specified in the Advertisement for Bid".

ADD the following new sentence to the end of Subparagraph 4.1.5:

4.1.5 [*Add:*] "Failure to enter an amount or "No Change", or a similar designation regarding the bid amount for a requested Alternate shall be construed to mean that no change in the Base Bid is required."

INSERT the following sentence after the second sentence of Subparagraph 4.1.7:

4.1.7 [*Insert:*] "The signature of any person, appearing on the Bid Form, shall be in longhand and in ink."

Paragraph 4.2 - Bid Security:

AMPLIFY Subparagraph 4.2.1 as follows:

4.2.1 [*Amplify:*] "Bid security in the type and amount stated in the Advertisement for Bids shall accompany the Bid. Bid Bonds shall be in the form set forth in the Project Manual. Bid bonds shall name as obligee and checks shall be made payable to School Board of the City of Staunton, VA. A Bidder who submits security in cash or check form shall be bound by the conditions set forth in the Bid Bond."

DELETE Subparagraph 4.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new

Subparagraph:

4.2.3 If a Surety Bond is used for the Bid Security, it shall be written on a form similar to the enclosed Bid Bond form only, and the Attorney-in-fact who executes the Bond on behalf of the Surety, shall affix to the Bond, a certified and current copy of its power of attorney.

DELETE Subparagraph 4.2.4 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.2.4 The Owner may declare the Bid Security forfeited to the Owner as liquidated damages if, following the designation, within the firm-bid period, of the Bidder as the apparently lowest responsible and responsive Bidder, such Bidder shall thereafter fail to (1) deliver to the Owner within the prescribed time the properly executed Performance Bond and Payment Bond if required by these Contract Documents or (2) if Notice of Intent to Award is given to such Bidder, deliver to the Owner, within the prescribed time, the properly executed counterparts of the construction Agreement and all evidences of insurance as required by these Contract Documents. The Bid Security of all Bidders will be returned (unless previously forfeited as aforesaid) upon (1) the execution of the construction Agreement by the Owner (provided in the case of the Bidder with whom said Agreement is entered into, all required evidences of insurance and Bonds have been previously delivered to the Owner) or (2) the rejection by the Owner of all bids or (3) the expiration of the firm-bid period, including any extensions by operation of law or by mutual consent of the Owner and the apparently lowest responsible Bidder.

Paragraph 4.3 - Submission of Bids:

ADD the following new sentence to the end of Subparagraph 4.3.2 as follows:

4.3.2 [*Add:*] "The Owner shall not be responsible for the opening of Bids not submitted in compliance with these Instructions to Bidders or Supplementary Instructions to Bidders."

ADD new Subparagraph 4.3.6 as follows:

4.3.6 [*Add:*] The documents to be submitted on bid day are as follows:

1. Two (2) Original Bid Form
2. Two (2) Bid Security
3. Two (2) Non-Collusion Affidavit
4. Two (2) Non-Discrimination Affidavit
5. Two (2) Contractor's Qualification Statement, AIA Document A305

ADD new Subparagraph 4.3.7 as follows:

4.3.7 [*Add:*] The Owner reserves the right to waive non-material defects or informalities in any and all bids to the full extent that Virginia law permits.

Paragraph 4.4 - Modification or Withdrawal of Bid:

DELETE Subparagraph 4.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new

Subparagraph:

4.4.1 A Bidder may withdraw its Bid at any time up to the scheduled time for opening of Bids. The withdrawal of a Bid prior to the deadline for bidding may occur only by appearing in person, by First-Class mail, or by fax. A Bid may not be modified after the deadline for submittal. After the deadline for submittal, no Bid may be withdrawn except as permitted by the Procurement Code of the Commonwealth of Virginia.

MODIFY the first sentence of Subparagraph 4.4.2 as follows:

4.4.2 [*Modify:*] "…… and these Bidding Documents."

DELETE Subparagraph 4.4.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

4.4.3 Bids may not be withdrawn by the Bidder for a period not to exceed 60 calendar days following the actual date of opening thereof, except as provided under the Virginia Public Procurement Act. However, if award of Contracts is delayed by a required approval of another government agency, the sale of bonds or the award of a grant or grants, the Bids may not be withdrawn by the Bidder for a period not to exceed 60 days from the date of Bid opening in accordance with Virginia Law.

4.5 Condifentiality

ADD a new paragraph 4.5 as follows:

4.5 Confidentiality

4.5.1. Bidders should give specific attention to the identification of those portions of their response which they deem to be confidential, proprietary information or trade secrets, and provide any justification of why the Owner should not disclose such materials, upon request. The Owner is a public body subject to the Virginia Freedom of Information Act (Va. Code § 2.2-3700 et seq.) and must disclose information, upon request, unless the law contains an exception permitting SCS to withhold the information. The submissions of Bidders are also subject to the provisions of Virginia Code § 2.2-4342(F) and this section.

4.5.2 Bidders must clearly indicate each page that is deemed confidential, proprietary or a trade secret. Bidders may NOT preface their entire response with a proprietary statement; such statements will not be effective to prevent disclosure of any portion of the response. Bidders should submit physical materials in such a way that pages marked as confidential, proprietary, or trade secrets can be readily separated, physically, from portions of the submission that are not so marked.

4.5.3 If the Owner determines that a page that a Bidder has designated "confidential" or "trade secret" is not entitled to protection from public disclosure under FOIA and Virginia Code § 2.2-4342(F), the Owner will provide notice of that determination to the contact person designated by the Bidder, in any reasonable manner that the Owner can provide such notice. If the Bidder does not initiate judicial proceedings to protect the confidentiality of the document within five (5) business days after the designated person received such notice, the Owner will not have any

obligation to withhold the document from public disclosure.

4.5.4 By submitting to the Owner a page that a Bidder designates as "confidential" or "trade secret", the Bidder agrees that in the event a third party brings any action against the Owner or any of its officials or employees to obtain disclosure of the document, the Bidder will indemnify and hold harmless the Owner and each organization's affected officials and employees from all costs, including attorney's fees, incurred by or assessed against any defendant, of defending against such action. The Bidder also agrees that at the Owner's request the Bidder will intervene in any such action and assume all responsibility for defending against it, and that the Bidder's failure to do so will relieve the Owner of all further obligations to protect the confidentiality of the document. All materials and information submitted during the ITB process will become the property of the Owner and will not be returned to the Proposer, except for the financial information, which shall be returned upon request after the Owner has determined to discontinue the procurement, or after the award of the contract.

4.6 – Owner's Officers/Employees Not to Benefit.

ADD a new paragraph 4.6 as follows:

4.6 OWNER'S OFFICERS/EMPLOYEES NOT TO BENEFIT.

4.6.1 Each Bidder's submission of a bid constitutes such Bidder's certification that that to the best of their knowledge no official or employee of Owner having official responsibility for the procurement transaction or member of his or her immediate family has received or will receive any financial benefit of more than nominal or minimal value relating to an award under this solicitation. If such a benefit has been received or will be received this fact shall be disclosed with the bid or as soon thereafter as it appears that such a benefit will be received. Failure to disclose the information prescribed above may result in suspension or debarment or recession of the contract made or could affect payment pursuant to the terms of the contract.

4.6.2 By submitting their bid, Bidders certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other Bidder, supplier, manufacturer or subcontractor in connection with their bid, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised unless consideration of substantially equal or greater value was exchanged.

4.6.3 Whenever there is reason to believe that benefit of the sort described in the paragraphs above has been or will be received in connection with bid, proposal or contract and that a Bidder has failed to disclose such benefit or has inadequately disclosed it, the Owner, as a prerequisite to payment pursuant to the agreement, or at any time may require the Bidder to furnish, under oath, answers to any interrogatories related to such possible benefit.

4.6.4 In the event a Bidder has knowledge of benefits as outlined above, this information should be submitted with the bid. If the above does not apply at time of award of contract and becomes known after inception of a contract the Bidder/Offeror shall address the disclosure of such facts to Owner's Budget Director.

ARTICLE 5 -CONSIDERATION OF BIDS

Paragraph 5.1 - Opening of Bids:

DELETE the first part of the first sentence of Paragraph 5.1 up to and including "or when otherwise required by law," and begin this sentence as follows:

5.1 "Bids properly identified and received ……"

5.1.1 Post Bid Assessment: To the full extent permitted under Section 2.2-4318 of the Code of Virginia, if the amount of the lowest responsible and responsive bid exceeds available funds, the Owner reserves the right to consider changes in the Work after Bid opening and prior to award of Contracts intended to reduce the cost of the Project. The Owner may at its election, begin discussions with the lowest responsible Bidder, based on low Base Bid and any Alternates determined to be acceptable to the Owner. After Bid opening and upon the Owner's identification of the apparent low bidder and the Owner's request, the apparent low bidder agrees to provide cost breakdowns in accordance with estimates used in the preparation of its Bid to the Owner and Architect, using cost breakdown forms that will be provided by the Architect. The confidentiality of such cost-breakdown and bid materials, when received, will be maintained by the Owner, the Architect and their representatives to the extent permitted by law. Such requests will be made only where, in the sole judgment of the Owner, the Owner's ability to fully fund the Project is detrimentally affected by the total amount of the lowest responsible and responsive Bids and accepted Alternates received from all Bidders. Matters to which such requests could be directed may include site work, landscaping, predetermined means and methods of construction, substitutions, deletions, changes in scope, and changes in schedule. Following receipt of the information requested, the Owner may propose deletions of Work and may at its option prepare draft deduct Change Orders. The Owner's award of the Contract to the Bidder can be made conditional upon the Bidder's consent and agreement to the execution of the proposed deduct Change Orders, following award and at a time contemporaneous with the execution of the Owner-Contractor Agreement. If through this process the Owner cannot achieve the cost reductions necessary to meet its budget parameters, the Owner reserves the right to reject all Bids associated with the Contract and re-bid the Project.

5.1.2 Each firm may submit only one bid. In the event a firm submits more than one bid, all bids that such firm submits will be disqualified.

Paragraph 5.2 - Rejection of Bids:

ADD new Subparagraph 5.2.1 as follows:

5.2.1 The Owner reserves the right to reject any or all Proposals, or parts thereof, or items therein. The Owner reserves the right to disqualify Bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices upon the part of the Bidder, or by other means permissible under applicable law.

Paragraph 5.3 - Acceptance of Bid Award:

AMPLIFY Subparagraph 5.3.1 as follows:

5.3.1 [*Amplify:*] The Owner, before making an award, may require any Bidder, upon at least three (3) days request to present satisfactory evidence, in the form specified by the Owner, of their experience, qualifications, financial ability, and other matters reasonably related to their ability to satisfactorily perform and complete the Work covered by their Bid.

The Owner reserves the right to consider such matters, facts and circumstances presented by the Bidder, as shall be permitted by Virginia law, in making a determination whether the Bidder is a responsible Bidder. The Owner reserves the right to request such other information or data as they may deem necessary to evaluate the qualifications of the Bidder to satisfactorily perform the functions of the Contractor.

The Bidder must submit a Contractor's Qualification Statement (AIA Document A305) in order to assist the Owner in determining whether a Bidder is responsible. The Owner would be pleased, as part of such evaluation, to review and consider any Virginia public school projects completed within the past 7 years of a minimum Contract value equal to or greater than the Bid amount of this Project. Also, provide names and numbers for the Superintendent, the Principal, the Construction Manager, if applicable, and the Architect for all public school projects completed within the past 7 years.

The Contractor's Qualification Statement may be supplemented by listing any principal, officer, or shareholder in your company who has either owned, operated or who was affiliated with any other business in a management capacity, under a different name. List the name of the business and provide a Contractor's Qualification Statement for such business.

ADD new Subparagraphs as follows:

5.3.3 After review of the Bids, during the Bid period stipulated in Article 4.4.1, at its sole discretion, the Owner may issue a Notice of Intent to Award. Upon receipt of Notice of Intent to Award, the Contractor shall, within five (5) calendar days, deliver to the Owner (by delivery to the Architect) the following:

1. Performance and Payment Bonds as set forth in the Contract Documents and Article 7 of the Instructions to Bidders.
2. Insurance Certificate, policies or other evidence of insurance set forth in the Contract Documents.
3. Post Bid Information required in Article 6 of the Instructions to Bidders.

Failure of the Bidder to whom Notice of Intent to Award has been given to deliver the above items required by the Contract Documents, within five (5) days, shall constitute

grounds for the Owner to declare the Bidder's Bid Security forfeited.

Upon receipt of the documents listed above, the Owner may at its sole discretion, award the Contract. A written Notice to Proceed will be issued to establish the start of the Contract duration.

5.3.4 Upon receipt of the partially executed Agreement from the Contractor, the Owner shall execute and return to the Contractor, one (1) copy of the executed Agreement and shall issue the Notice to Proceed for the Work.

5.3.5 When a Unit Price is rejected by the Owner, any additional work that would have been subject to that unit price shall be subject to Article 7 of the General Conditions of the Contract for Construction and the Supplementary General Conditions.

ARTICLE 6 - POST BID INFORMATION

DELETE Paragraph 6.1 in its entirety. SUBSTITUTE the following paragraph:

[Substitute:] 6.1 As a matter of policy, the Owner does not endorse the products or services of a contractor. News releases concerning any resultant contract from this solicitation will not be made by a contractor without the prior written approval of the Owner. All proposed news releases will be routed to the Owner's Budget Director for review and approval.

DELETE Paragraph 6.2 - Owner's Financial Capability, in its entirety.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

Paragraph 7.1 - Bond Requirements:

DELETE Subparagraph 7.1.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.1.1 Prior to execution of the Contract, the successful Bidder shall furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the forms included in the Project Manual and each in an amount equal to 100% of the Contract Amount. The Performance Bond shall remain in force and effect until the Contractor's Work has been finally accepted. The Bidder shall pay all premiums with respect to such bonds.

DELETE Subparagraph 7.1.2 in its entirety.

DELETE Subparagraph 7.1.3 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.1.3 Bonds shall be secured from a surety company as stipulated in Section 000750 Supplementary General Conditions.

Paragraph 7.2 - Time of Delivery and Form of Bonds:

DELETE Subparagraph 7.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.1 The Bidder shall deliver properly executed bonds to the Owner (by delivery to the Architect) no later than five (5) days after written Notice of Intent to Award is issued.

DELETE Subparagraph 7.2.2 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.2 Bonds shall be written on the Performance Bond form and the Payment Bond form included in the Contract Documents for the amount required in the Contract Documents.

7.2.2.1 The Contract Bonds shall be written in the form included in the Project Manual and the Bonds shall be executed by or on behalf of the successful Bidder, as Principal, in the following manner:

7.2.2.2 If the successful Bidder is an individual, the Contract Bonds shall be executed by them personally, their signature shall be witnessed and any trade name employed in the conduct of their business shall be stated.

7.2.2.3 If the successful Bidder is a partnership, the Contract Bonds shall be executed in the name of the partnership by each of the Partners, and the signatures of the Partners shall be witnessed.

7.2.2.4 If the successful Bidder is a corporation, the Contract Bonds shall be executed in the name of the corporation: (1) by the President or a Vice President and attested by the Secretary or Assistant Secretary and the Corporate Seal shall be attached; (2) by a duly authorized agent of the corporation whose authority to act, as of the date of the Contract Bonds, shall be established by proof, satisfactory to the Owner, attached to the Contract Bonds.

7.2.2.5 If the successful Bidder is a limited liability company, the Contract Bonds shall be executed in the name of the limited liability company: (1) by a Manager, in the case of a Manager-managed limited liability company; or (2) in the case of a limited liability company that is not Manager-managed, by a duly authorized Member or other officer of the limited liability company, whose authority to act, as of the date of the Contract Bonds, shall be established by proof, satisfactory to the Owner, attached to the Contract Bonds.

7.2.2.6 Execute the Contract Bonds in behalf of the surety in such manner as to legally bind the surety. In the event the execution in behalf of the surety is by an agent or agents, a proper power of attorney, evidencing the authority of such agent or agents, shall be attached to the Contract Bonds. Such power of attorney shall bear the same date as the Contract Bonds to which it is attached.

7.2.2.7 Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

ARTICLE 8 - ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

DELETE Subparagraph 8.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

8.1 The Agreement shall be written on the form included in these Contract Documents.

ARTICLE 9 CONSTRUCTION TIME

ADD new Article 9 as follows:

Paragraph 9.1 - Pre-Bid Conference:

9.1.1 Prospective Bidders and Sub-bidders are invited to attend a Pre-Bid Conference at the time and location stated in the Advertisement for Bids during which questions of general and technical nature and other matters regarding the Construction Documents may be raised by those in attendance and discussed with the Owner, the Architect and the Engineers.

Paragraph 9.2 - Pre-Construction Conference:

9.2.1 Soon after the award of the Contract but prior to the start of construction, the Contractor or their representative shall attend a Pre-Construction Conference with representatives of the School Board of the City of Staunton, VA and the Architect. The conference will serve to acquaint the participants with the general plan of Contract administration and requirements under which the construction operation is to proceed and will inform the Contractor, in detail, of the obligations imposed on them and their subcontractors by the Executive Orders concerning Equal Employment Opportunity.

9.2.2 The date, time and place of the conference will be furnished to the Contractor by the Architect.

Paragraph 9.3- Contract Time:

9.3.1 The Agreement will include a stipulation that the Work be substantially complete (as defined in the Contract) within **465** calendar days, and that completion of ALL punch list work and Final Acceptance of the Work be achieved within **488** calendar days.

Paragraph 9.4- Time of Completion:

9.4.1 The Bidder agrees that they will commence work within forty-eight (48) hours following receipt of Notice to Proceed from the Owner (which may be given by the Architect pursuant to authority granted by the Owner) and shall be substantially completed within the number of calendar days set forth herein.

9.4.2 By submitting a Bid, the Bidder certifies that they shall coordinate the schedule for the construction of the Project including, but not limited to, preparing and updating the Schedule.

9.4.3 By submitting a Contract Bid, the Bidder certifies that the Contract Time set forth herein is sufficient for the Bidder to complete its Work.

Paragraph 9.5- Non-Interference with Owner's Operations:

9.5.1 The Contractor shall schedule their Work accordingly and shall cooperate with the Owner to see that daily operations are disrupted as little as possible. No work shall begin until it is fully coordinated with the Owner so that the Owner can make provisions to allow for the disruption that the work will cause. The Owner shall be given at least five (5) days' notice before any work is to be started. This notice shall be in writing.

9.5.2 The Contractor shall erect temporary barriers to segregate the area of new construction from the existing facility and remainder of the Owner's property. It is the intention that these temporary barriers be constructed to prevent the flow of dust dirt, debris, etc., into the adjacent areas of the facility. The temporary barriers must also serve as safety barriers to prevent access of unauthorized people into the work area.

9.5.3 The Contractor must maintain access to the Owner's facilities for employees, visitors, other users, and deliveries. In no way shall the Contractor prevent access to the remaining portions of the site.

ARTICLE 10 - GOVERNING LAWS AND REGULATIONS

ADD new Article 10 as follows:

Paragraph 10.1 – Governing Laws and Regulations

10.1.1 The Bidder's attention is directed to the fact that all applicable Federal and State laws, municipal ordinances and codes, and the rules and regulations of all authorities having jurisdiction over construction of the Project may apply to this Contract, including without limitation.

END OF SECTION 000101

BID FORM - GENERAL CONSTRUCTION - CONTRACT 3636-1

DATED:_____
(Bidder to insert date bid submitted

Bidder's Name and Address (Print or Type)

School Board of the
City of Staunton, VA

_____

_____

116 W. Beverley St
Staunton, VA 24401

_____

To Whom It May Concern:

This Bid is submitted in accordance with your Advertisement inviting Bids to be received for the General Construction Work for Shelburne Middle School Additions and Renovations, Staunton City Schools, Staunton VA.

Having carefully examined the Contract Documents as defined in Article 1 of the Agreement, bound in the Specifications, and including the Addenda enumerated in the Bid, which are incorporated with these documents indicating various conditions affecting this Contract, the undersigned herein agrees to furnish all materials, perform all labor and do all else necessary to complete the Contract for the above named Project in accordance with said Contract Documents for:

Total Base Bid Project Cost for All General Construction

_____ DOLLARS

($_____).

Accompanying this Bid is a certified check, bank cashier's check, bank treasurer's check or Bid Bond required by Paragraph 4.2 of the Instructions to Bidders which is deposited as a bid guarantee, and is to be retained by you and applied as provided in Paragraph 4.2.1 of the Instructions to Bidders, in case the undersigned shall default in executing the Contract or in furnishing the required Bonds and insurance certificates within the time specified by these Contract Documents.

The undersigned hereby certifies that this Bid is genuine, and is not a sham or collusive, or made in the interest of, or on behalf of any person, firm or corporation not herein named, and that the undersigned has not directly or indirectly induced or solicited any bidder to refrain from bidding and that the undersigned has not in any manner sought by collusion to secure for itself, any advantages over any other bidder.

The undersigned, intending to be legally bound, agrees that this Bid shall be irrevocable and shall remain subject to your acceptance for 60 days after the date set for bid opening.

It is hereby certified that the undersigned is the only person(s) or entity(ies) interested in this Bid as Principal, and that the Bid is made without collusion with any person, firm or corporation. The Bidder hereby agrees to furnish surety company bonds in the form incorporated in the Contract Documents, in the amount of one hundred percent (100%) of the Contract Price for the Performance Bond and the

Payment Bond as surety against defects or inferior materials or workmanship which may develop during the period of one (1) year from the date of completion and acceptance of the Work performed under the Contract, within ten (10) days after notice by the Owner of the intention to award the Contract and execute the Agreement and furnish evidence of require insurance coverage, upon request, within ten (10) days after mailing by the Owner of Notice of Intent to Award, and to commence work within forty-eight (48) hours after receipt of Notice to Proceed.

The Bidder guarantees that, if awarded a Contract, it will furnish and deliver all materials, all specified temporary facilities and controls, tools, equipment, tests, and transportation, to secure all permits and licenses, to do and perform all labor, superintendence, and all means of construction, pay all fees (unless specifically noted otherwise), and do all incidental Work, and to execute, construct and finish, in an expeditious, substantial and workmanlike manner in accordance with the plans and specifications, to the complete satisfaction and acceptance of the Owner for the price herein stated.

It is understood that Staunton City Schools reserves the right to reject any or all Bids or Proposals, or parts thereof, or items thereof, and to waive technicalities required for the best interests of the Owner.

The undersigned submits this Bid with the full knowledge of the Contract requirements and hereby agrees that Work of this Project, under this Contract, shall be **substantially completed in 390 calendar days,** which period shall be the essence of the Contract. Each phase of construction will have its own substantial completion date. See Section 011000 Summary of Work.

The Bidder agrees that it will not assign its Bid or any of its rights or interests hereunder without written consent of the Owner.

The undersigned Contractor agrees to furnish all labor and materials for any additional work ordered by the Owner, and for which no pre-agreed price has been fixed, for the net cost of all labor and materials furnished plus the contracted markup noted in Article 6 of the Supplementary General Conditions.

THE BID FORM AND THE FOLLOWING ATTACHMENTS SHALL BE SUBMITTED IN DUPLICATE:

1. Two (2) Bid Security
2. Two (2) Contractor's Qualification Statement (AIA Document A305)
3. Two (2) Virginia SCC number
4. Two (2) Non-Collusion Affidavit

ALTERNATES: The Instructions to Bidders and the Contract Documents comprising the plans and specifications, and all documents bound therewith, together with all Addenda thereto, shall apply to all Alternate Bids as listed in Division 1 Section "Alternates", and as listed below:

GC-1	Multipurpose Room Addition	ADD	$ _____
GC-2	Renovations – Administration Area	ADD	$ _____
GC-3	Masonry Wall Repair	ADD	$_____
GC-4	Multipurpose Room Addition- Unclassified	ADD	$_____

UNIT PRICES: The Instructions to Bidders and the Contract Documents comprising the plans and specifications, and all documents bound therewith, together with all Addenda thereto, shall apply to all Unit Prices as listed in Division 1 Section "Unit Prices", and as listed below:

The Owner reserves the right to accept or reject any and all Unit Prices stipulated on the Bid Form.

UNIT PRICES

GC-1	Bulk Soil Excavation	$_____CY
GC-2	Borrow Soil Replacement	$_____CY
GC-3	Trench Rock Removal and Replacement	$_____CY
GC-4	Bulk Rock Removal and Replacement	$_____CY
GC-5	Cutting and Patching of Concrete Floor Slabs	$_____SF
GC-6	Cementitious Underlayment	$_____SF
GC-7	Repointing of existing brickwork	$_____SF
GC-8	Cleaning of existing brick	$_____SF
GC-9	Trench Soil Excavation and Replacement	$_____CY

ADDENDA

The undersigned hereby acknowledge receipt of following Addenda and has prepared this bid accordingly:

ADDENDUM #_____	Dated_____	ADDENDUM #_____	Dated_____
ADDENDUM #_____	Dated_____	ADDENDUM #_____	Dated_____

Bids shall be officially signed in accordance with the Instructions to Bidders, using the applicable portion of the "Signature Pages".

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Individual Bidder

_____
Name of Bidder (Printed)

_____ By: _____
Witness (Signature of Individual)

Trading and doing business as *_____

Business Address_____

*If a fictitious or trade name is employed in the conduct of business, insert name here:

_____

Next, complete, by deletion as appropriate, the following statement:

Foregoing fictitious or trade name (has) (has not) been registered by the individual proprietorship under Virginia Law.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Partnership Bidder

*_____

(Name of Partnership)

_____

Name of General Partner (Printed)

_____ By: _____

Witness (Signature of General Partner)

Business Address_____

The Partners constituting the Partnership herein named are:

Partner	Address
Partner	Address
Partner	Address
Partner	Address

[Add additional lines for the names and addresses of additional Partners, if there are more than four Partners in the Partnership, by attaching an additional page or pages to this Bid.]

*If a fictitious or trade name is employed by the Partnership in conduct of its business, insert name here:

_____

Next, complete, by deletion as appropriate, the following statement:

Foregoing fictitious or trade name (has) (has not) been registered by the partnership under Virginia Law.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Corporate Bidder

_____

(Name of Corporation)

By:_____ Attest:_____

Signature of President, Vice President, or other authorized representative *

Signature of Secretary, Assistant Secretary, Treasurer, Assistant Treasurer or other authorized representative **

(CORPORATE SEAL)

Business Address_____

* If a representative other than the President or a Vice President of the Corporation signs this Bid on its behalf, then attach a valid corporate resolution or other appropriate proof, dated prior to or as of the date of the Bid, evidencing authority to execute this Bid on behalf of the Corporation.

** If a representative other than the Secretary, an Assistant Secretary, the Treasurer or an Assistant Treasurer attests to the signature of the corporate representative, then attach a valid corporate resolution or other appropriate proof, dated prior to or as of the date of the Bid, evidencing authority to attest to the execution of this Bid on behalf of the Corporation.

(1) Complete the following statement:

The Corporation has been organized and is existing under laws of the State/Commonwealth of

_____

(2) If the Corporation has been organized under laws of a State other than those of the Commonwealth of Virginia, complete, by deletion as appropriate, the following statement:

The Corporation (has) (has not) been granted a certificate of authority to do business in the Commonwealth of Virginia under applicable laws.

(3) If the Corporation has been organized under laws other than those of the Commonwealth of Virginia and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement:

The Corporation (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Virginia and (has) (has not) attached a copy of the pending application to this Bid.

SIGNATURES

IN WITNESS WHEREOF, the undersigned has caused this Bid to be executed as of the day and year indicated on the first page hereof.

For Limited Liability Company (LLC) Bidder

[Name of Contractor]

_____
(Print Name of Limited Liability Company)

Attest:_____ By: _____
Signature of an authorized representative* Signature of an authorized representative**

* The individual attesting verifies and represents that the person whose signature is affixed to this Bid on behalf of the Limited Liability Company (LLC) is duly authorized in accordance with the representations hereafter set forth.

** Check the box which applies to this Bid:

□ The Certificate of Organization or operating agreement provide that the LLC is to be managed by managers, and this Bid has been executed by a Manager fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

□ The Certificate of Organization and operating agreement do not provide that LLC is to be managed by managers, and this Bid has been executed by a Member fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

□ This Bid has been executed by a representative of the LLC who is not a Manager or a Member of the LLC, and instead who holds the office of _____ (insert title), and the execution of this Bid is fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days.

The Bidder and the individuals signing and attesting to the execution of this document further represent that (1) execution of the Bid is carrying on business in the usual way; (2) the LLC authorizes the execution of this Bid even if execution and submission of this Bid is not carrying on business in the usual way for the LLC; and (3) to the best of the individuals' information and belief, the Owner has no knowledge of the Member's or the Manager's lack of actual authority, or of any applicable and relevant restriction on his or her authority.

Continued on next page

Complete the following statement:

The LLC has been organized and is existing under laws of the State/Commonwealth of:

_____

If the LLC has been organized under laws of a State other than those of the Commonwealth of Virginia, complete, by deletion as appropriate, the following statement:

The LLC (has) (has not) been granted a certificate of authority to do business in the Commonwealth of Virginia under applicable laws.

If the LLC has been organized under laws other than those of the Commonwealth of Virginia and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement:

The LLC (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Virginia and (has) (has not) attached a copy of the pending application to this Bid.

AIA® Document A305® – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)

SUBMITTED TO:
(Organization name and address.)

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

[ ] Exhibit A – General Information
[ ] Exhibit B – Financial and Performance Information
[ ] Exhibit C – Project-Specific Information
[ ] Exhibit D – Past Project Experience
[ ] Exhibit E – Past Project Experience (Continued)

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

Organization's Authorized Representative Signature **Date**

Printed Name and Title

NOTARY
State of:
County of:
Signed and sworn to before me this day of

Notary Signature

My commission expires:

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

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

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User Notes: (1363302979)

AIA® Document A305® – 2020 Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

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

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

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

.2 If your organization is a partnership, identify its partners and its date of organization.

.3 If your organization is individually owned, identify its owner and date of organization.

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User Notes: (1865511784)

.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

§ A.1.3.2 How many full-time employees work for your organization?

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

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AIA® Document A305® – 2020 Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

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

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

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 failed to complete work awarded to it?

.2 been terminated for any reason except for an owners' convenience?

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.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

.4 filed any lawsuits or requested arbitration regarding a construction project?

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

.2 had any business or professional license subjected to disciplinary action?

.3 been penalized or fined by a state or federal environmental agency?

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AIA® Document A305® – 2020 Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

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

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§ **C.1.5** Identify portions of work that you intend to self-perform on this Project.

§ **C.1.6** To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ **C.2.1** Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may complete Exhibit E.

§ **C.2.2** State the total dollar value of work currently under contract at the Contractor's Project Office:

§ **C.2.3** Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

§ **C.2.4** State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

§ **C.2.5** List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

§ C.3 SAFETY PROGRAM AND RECORD

§ **C.3.1** Does the Contractor's Project Office have a written safety program?

§ **C.3.2** List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

§ **C.3.3** Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ **C.3.4** Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ **C.4.1** Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

§ **C.4.2** If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

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§ **C.4.3** Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.2? If so, identify.

§ C.5 SURETY

§ **C.5.1** If requested, will your organization be able to provide a performance and payment bond for this Project?

§ **C.5.2** Surety company name:

§ **C.5.3** Surety agent name and contact information:

§ **C.5.4** Total bonding capacity:

§ **C.5.5** Available bonding capacity as of the date of this qualification statement:

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AIA® Document A305® – 2020 Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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AIA® Document A305® – 2020 Exhibit E

Contractor's Past Project Experience, Continued

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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SECTION 000429 NON-COLLUSION AFFIDAVIT OF CONTRACTOR

State of_____

County of _____

(Name) _____being first duly sworn, states that:

(1) They are_____(owner, partner, office, representative agent)

of_____(Company),

the Bidder that has submitted that attached Bid;

(2) They are fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affidavit, has, in any way, colluded, conspired, connived, or agreed, directly or indirectly with any other bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, firm or person, to fix the price or prices in the attached Bid or of any other bidder, or to fix any overhead, profit, or cost element of the Bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Staunton City Schools or any person interested in the proposed Contract; and,

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affidavit.

_____ */s/*

_____ Title

Subscribed and sworn to before me this _____ day of _____, 20____.

By: _____ _____

Notary Public My Commission Expires:

AIA® Document A101™ – 2017

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

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

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

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

CONTRACT:

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

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

The Owner and Contractor agree as follows.

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

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

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

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

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.

[X] 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 **as stipulated in Article 9 of Specification Section 00010 and further defined on the Bid Form for this Contract**:
(Check one of the following boxes and complete the necessary information.)

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

[ ] By the following date:

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

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

Item	Price

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

Item	Price	Conditions for Acceptance

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

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if **stipulated in Paragraph 8.4 of Specification Section 000750 or another Contract Document, shall be**:
(Insert terms and conditions for liquidated damages, if any.)

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

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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, **and approved by the Owner,** the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

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

§ 5.1.3 Refer to Article 9 of Specification Section 000750 and Specification Section 012900 for further information. The payment schedule will also be finalized at the first Pre-Construction Meeting.
(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.)

In accordance with AIA Document A201-2017 and as further described in Article 9 of Specification Section 000750.

§ 5.1.7.1.1 The following items are not subject to retainage:

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

In accordance with Article 9 of AIA Document A201-2017 and as further described in Article 9 of Specification Section 000750.

§ 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.)

In accordance with Article 9 of AIA Document A201-2017 and as further described in Article 9 of Specification Section 000750.

§ 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.)

In accordance with Article 9 of AIA Document A201-2017 and as further described in Article 9 of Specification Section 000750.

§ 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 **and approved by the Owner**.

§ 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, **and approval by the Owner.**

§ 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.)

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§ 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.)

[
(Paragraphs deleted)
X] Pursuant to **Article 15** of AIA Document A201–2017 **and further modified in Specification Article 15 of Section 000750**

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.

(Paragraphs deleted)
§ 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
AIA Document A101™ -2017, Exhibit A, Insurance and Bonds, referenced on Page 1 of this Agreement is not being incorporated as part of this Agreement.

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in **AIA Document A201™–2017, General Conditions of the Contract for Construction, Article 11 of Specification Section 000750,** and elsewhere in the Contract Documents.

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§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A201™–2017, General Conditions of the Contract for Construction, **Article 11 of Specification Section 000750, Article 7 of Specification Section 000101,** 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 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(Paragraphs deleted)
§ 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 **as modified**

.2 **Intentionally deleted**

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

.4

(Paragraphs deleted)

Intentionally deleted

.5 Drawings

Number	Title	Date
See Exhibit A – List of Drawings		

.6 Specifications

Section	Title	Date	Pages
See Exhibit B – Table of Contents			

.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.)

[
(Paragraphs deleted)
X] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
See Exhibit B – Table of Contents			

(Paragraphs deleted)

.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,

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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.)

Exhibits A List of Drawings and Exhibit B Table of Contents

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

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

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SECTION 000515 - CITY OF STAUNTON / VPPA PROJECT REQUIREMENTS / FEDERAL REQUIREMENTS

The provisions of this Section 000515 are prescribed by state or other law, and become part of the final agreement of the successful Bidder. By bidding on the Project, each Bidder signifies agreement to these provisions.

PART 1 - GENERAL

1.1 ANTI-DISCRIMINATION:

By submitting proposals, Bidders certify to Owner that they will comply with the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, when applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and § 2.2-4311 of the *Virginia Public Procurement Act (VPPA).*

In every contract over $10,000 the provisions in 1. and 2. below apply:

1. During the performance of this contract, the contractor agrees as follows:

    a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

    b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

    c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting these requirements.

2. The contractor will include the provisions of 1. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

1.2 ETHICS IN PUBLIC CONTRACTING:

A. By submitting proposals, Bidders certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other Bidder, supplier, manufacturer or subcontractor in connection with their proposal, and that they

have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged Work covered by Contract Documents.

1.3 IMMIGRATION REFORM AND CONTROL ACT OF 1986:

A. By entering into a written contract with Owner, the Contractor certifies that the Contractor does not, and shall not during the performance of the contract for goods and services for Owner, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.

1.4 DEBARMENT STATUS:

By participating in this procurement, the Bidder certifies that it is not currently debarred by the Commonwealth of Virginia or Owner from submitting a response for the type of goods and/or services covered by this solicitation. Bidder further certifies that they are not debarred from filling any order or accepting any resulting order, or that it is are an agent of any person or entity that is currently debarred by the Commonwealth of Virginia or Owner.

1.5 RECORDS RETENTION:

If successful, the Bidder hereby agrees to retain all books, records, and other documents relative to this contract for three (3) years after final payment, or until audited by the Owner, whichever is sooner. The Owner, its authorized agents, and/or auditors reserve the right to perform or have performed an audit of the records of the Contractor pertaining to this Project and therefore shall have full access to and the right to examine any of said materials within a reasonable period of time during said period.

1.6 ANTITRUST.

By entering into a contract pursuant to this solicitation, the Bidder conveys, sells, assigns, and transfers to the Owner all rights, title and interest in and to all causes of the action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the Owner under said contract.

1.7 CHARGES AND PAYMENTS TO SUBCONTRACTORS—GENERAL:

A. Payment to Subcontractors From Funds that Contractor Receives.

1. A Bidder awarded a contract under this solicitation is hereby obligated:
   (a) To pay the subcontractor(s) within seven (7) days of the Bidder's receipt of payment from Owner for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or
   (b) To notify the Owner and the subcontractor(s), in writing, of the Bidder's intention to withhold payment and the reason.
2. The Bidder is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the Bidder that remain unpaid seven (7) days following receipt of payment from Owner, except for amounts withheld as stated in (A)(1)(b) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. An Bidder's obligation to pay an interest charge to a subcontractor is not an obligation of Owner.

B. Payment to Subcontractors When Contractor Has Not Received Funds

In the event that the Bidder awarded a contract under this solicitation has not received payment from the Owner for work performed by a subcontractor under such contract, such Bidder is liable for the entire amount owed to such subcontractor and to pay such subcontractor within 60 days of the receipt of an invoice following satisfactory completion of the work for which the subcontractor has invoiced. Such Bidder shall not be liable for amounts otherwise reducible due to the subcontractor's noncompliance with the terms of the contract. However, in the event that the Bidder withholds all or a part of the amount invoiced by the subcontractor under the terms of the contract, the contractor shall notify the subcontractor within 50 days of the receipt of such invoice, in writing, of his intention to withhold all or a part of the subcontractor's payment with the reason for nonpayment, specifically identifying the contractual noncompliance, the dollar amount being withheld, and the lower-tier subcontractor responsible for the contractual noncompliance. Payment by the party contracting with the contractor shall not be a condition precedent to payment to any lower-tier subcontractor, regardless of that contractor's receiving payment for amounts owed to that contractor. This paragraph shall not apply to any amounts withheld as retainage under the applicable contract.

C. Tax Identification Numbers.

Individual contractors or subcontractors shall provide their social security numbers. Proprietorships, partnerships, and corporations (or other entities taxed as one of the foregoing under federal law) shall provide their federal employer identification numbers.

1.8 QUALIFICATIONS OF BIDDERS

A. By submitting a proposal, a Bidder authorizes Owner to make such reasonable investigations with the Bidder and with any third party, as deemed proper and necessary in the sole discretion of the Owner to determine the ability of the Bidder to perform the services under this Bid, and the Bidder also authorizes the third party to provide any information requested by Owner, even if the information is adverse to the Bidder. Owner reserves the right to inspect Bidder's physical facilities and previous work and record prior to award to satisfy questions regarding the Bidder's capabilities. Owner further reserves the right to reject any proposal if the evidence submitted by, or investigations of, such Bidder fails to satisfy Owner that such Bidder is fully qualified to carry out the obligations of the contract and to provide the procured services in all respects.

1.9 TAXES:

Sales to Owner are exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request, as Owner determines appropriate.

1.10 DRUG-FREE WORKPLACE

A. During the performance of a contract, the Bidder agrees to: (1) provide a drug-free workplace for the Bidder's employees; (2) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Bidder's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (3) state in all solicitations or advertisements for employees placed by or on behalf of the Bidder that the Bidder maintains a drug-free workplace; and (4) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

B. For the purposes of this section, "*drug-free workplace"* means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

1.11 AVAILABILITY OF FUNDS:

It is understood and agreed between the parties herein that Owner shall be bound and liable hereunder only to the extent of the funds appropriated by the governing body of the City of Staunton for the purpose of this Contract, it being understood by the parties that Owner is subject to Virginia Code § 22.1-91, which prohibits a school board from expending or contracting

to expend, in any fiscal year, any sum of money in excess of funds available for school purposes for that fiscal year without the consent of the governing body.

1.12 AUTHORIZATION TO CONDUCT BUSINESS IN THE COMMONWEALTH:

A Bidder organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the *Code of Virginia* or as otherwise required by law. Any business entity described above that enters into a contract with a public body pursuant to the *Virginia Public Procurement Act* shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. Owner may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section. Any LLC Bidder's signatory to any document related to this procurement shall be regarded as a declaration under penalty of perjury that the signatory has full authority to execute the document as a legally binding obligation of the LLC and there are no restrictions or conditions to the LLC's contractual commitment or the execution of all documents related thereto.

1.13 PUBLIC INSPECTION OF PROCUREMENT RECORDS:

A. Proposals submitted shall be subject to public inspection only in accordance with Section 2.2-4342 of the Code of Virginia as follows:

1. Except as provided in this section, all proceedings, records, contracts and other public records relating to procurement transactions shall be open to the inspection of any citizen, or any interested person, firm or corporation, in accordance with the Virginia Freedom of Information Act (§ 2.2-3700 et seq.).

2. Cost estimates relating to a proposed procurement transaction prepared by or for a public body shall not be open to public inspection.

3. Any competitive negotiation Bidder, upon request, shall be afforded the opportunity to inspect proposal records within a reasonable time after the evaluation and negotiations of proposals are completed but prior to award, except in the event that the public body decides not to accept any of the proposals and to reopen the contract. Otherwise, proposal records shall be open to public inspection only after award of the contract.

4. Any inspection of procurement transaction records under this section shall be subject to reasonable restrictions to ensure the security and integrity of the records.

5. Trade secrets or proprietary information submitted in connection with a procurement transaction or prequalification application consistent with and pursuant to subsection B of § 2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 et seq.); however, the Bidder shall (a) invoke the protections of this section prior to or upon submission of the data or other materials, (b) identify the data or other materials to be protected, and (c) state the reasons why protection is necessary, all to the extent required by law.

1.14 CERTIFICATION REGARDING CRIMES AGAINST CHILDREN:

A. The Bidder does and shall further certify and be considered to be making ongoing certification that the Bidder's directors, members, officers and employees, and all other persons who will have direct contact with students on school property during regular school hours or during school-sponsored activities have not been convicted or charged with a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child. In accordance with this paragraph, the Bidder shall execute the certification attached hereto as Attachment A and submit the certification contemporaneously with an executed Contract. This includes all contractors working on the site at any time. Any contractor who has not submitted the certification to the Owner prior to arrival onsite will be dismissed from the site.

B. Pursuant to Code of Virginia §22.1-296.1, any person making a materially false statement regarding offenses which are required to be included in the certification referenced above shall be guilty of a Class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of the contract to provide such services and, when relevant, the revocation of any license required to provide such services. Owner shall not be liable for materially false statements regarding the certifications required under this Contract.

1.16 FBI CHRI REPORTS

Contractor must submit background check reports, including the federal criminal history record information (CHRI) reports of all prospective employees and independent contractors who will have contact with children. All such background checks must be complete and have been reviewed by Owner prior to Contractor entering the Project site. This includes all contractors working on the site at any time. Any contractor who has not submitted CHRI to the Owner prior to arrival onsite will be dismissed from the site.

1.17 COMPANY WORKSITE BADGE

All Contractors working onsite must have a visible company badge at all times. The badge must include the company name, name of employee and a photo of the employee. The

Contractor must submit the Certification regarding crimes against children and FBI clearance to the Owner's Representative prior to arrival onsite. If approved, the Contractor will receive an additional badge/tag from the School Division showing they have their clearances to be onsite. Contractors without both their company ID and school provided badge will be removed from the site.

1.18 CERTIFICATION OF INTEREST & RELATIONSHIPS WITH THE STAUNTON CITY SCHOOL BOARD/STAUNTON CITY SCHOOLS EMPLOYEES:

The extent that neither Offeror nor any of Offeror's officers, directors, or executive employees, maintains a financial or familial or any business relationship with any person acting for, or employed by, SCS, and or Staunton City School Board members of the Board itself, the offeror shall reveal and fully describe such relationships in writing, which shall be made public. In accordance with this paragraph, the offeror shall execute the certification attached hereto as Attachment Band submit the certification contemporaneously with this executed Contract.

1.19 PROOF OF STATE CORPORATION COMMISSION NUMBER

All prime and subcontractors shall certify that it is authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity by providing proof of registration with the VA Corporation Commission.

Contract Provisions for Non-Federal Entity Contracts Under Federal Awards

In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

1. Contracts for more than the simplified acquisition threshold currently set at $250,000, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by *41 U.S.C. 1908*, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.
2. All contracts in excess of $10,000 must address termination for cause and for convenience by the non-federal entity including the manner by which it will be affected and the basis for settlement.
    a. **Termination for Convenience**. Contract is terminated due to reasons known to COS, i.e., program changes, changes in state-of-the art equipment or technology, insufficient funding, etc. Termination is utilized when the contractor is not in violation of the contract terms and conditions.
    b. **Termination for Cause**. Contract is terminated due to actions by the contractor, i.e., failure to perform, financial difficulty, slipped schedules, etc. In certain instances, termination settlement may include re-procurement costs to be paid by the contractor.
3. Equal Employment Opportunity. Except as otherwise provided under *41 CFR Part 60*, all contracts that meet the definition of "federally assisted construction contract" in *41 CFR Part 60-1.3* must include the equal opportunity clause provided under *41 CFR 60-1.4(b)*, in accordance with Executive Order 11246, "Equal Employment Opportunity" (*30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339*), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at *41 CFR part 60*, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
4. Davis-Bacon Act, as amended (*40 U.S.C. 3141-3148*). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (*40 U.S.C. 3141-3144, and 3146-3148*) as supplemented by Department of Labor regulations (*29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"*). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be

conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (*40 U.S.C. 3145*), as supplemented by Department of Labor regulations (*29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"*). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

5. Contract Work Hours and Safety Standards Act (*40 U.S.C. 3701-3708*). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and *3704*, as supplemented by Department of Labor regulations (*29 CFR Part 5*). Under *40 U.S.C. 3702* of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of *40 U.S.C. 3704* are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

6. Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under *37 CFR § 401.2 (a)* and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of *37 CFR Part 401*, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

7. Clean Air Act *(42 U.S.C. 7401-7675*) and the Federal Water Pollution Control Act (*33 U.S.C. 1251-1388*), as amended - Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (*42 U.S.C. 7401-7675*) and the Federal Water Pollution Control Act as amended (*33 U.S.C. 1251-1388*). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

8. Debarment and Suspension (Executive Orders 12549 and 12689) - A contract award (*see 2 CFR 180.220*) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at *2 CFR 180* that implement Executive Orders 12549 (*3 CFR part 1986 Comp., p. 189*) and 12689 (*3 CFR part 1989 Comp., p. 235*), "Debarment and Suspension." SAM Exclusions

contaiExecutive Order 12549.

9. Byrd Anti-Lobbying Amendment (*31 U.S.C. 1352*) - Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by *31 U.S.C. 1352.* Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.
10. §200-323Procurement of recovered materials. A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at *40 CFR part 247* that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.
11. To the extent that a procurement award or transaction for goods or services under this purchase order or other contract is funded with federal funds under American Rescue Plan Act (ARPA), the successful bidder or proposer or awardee must comply with the federal domestic preference for procurements requirements of the federal regulations prescribed in Section 200.322 of Title 2 of the Code of Federal Regulations (CFR). The successful bidder or proposer or awardee certifies that any contracts, as well as any subcontracts, shall include this requirement, which mandates that to the greatest extent practicable there shall be a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). Definition of the terms “produced in the United States” and “manufactured products” may be found in the CFRS at: Electronic Code of Federal Regulations (eCFR) or successor url. And to the extent not in compliance with such requirements, the successful bidder or proposer or awardee shall indemnify, defend and hold harmless the City of Staunton, to the fullest extent permitted by law
12. § 200.216 Prohibition on certain telecommunications and video surveillance services or equipment.
    a. Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:
        1. Procure or obtain;
        2. Extend or renew a contract to procure or obtain; or

3. Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

    i. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

    ii. Telecommunications or video surveillance services provided by such entities or using such equipment.

    iii. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

b. In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

c. See Public Law 115-232, section 889 for additional information.

d. See also § 200.471.

END OF SECTION 000515

ATTACHMENT A

CERTIFICATION REGARDING CONTACT WITH CHILDREN

Contractor acknowledges that, to the extent the implementation of this contract requires Contractor, Contractor's employees or other persons within Contractor's control to have direct contact with Staunton City Schools' students, the Contractor hereby certifies, and is deemed to be continuously certifying, that neither Contractor, Contractor's employees nor any person who will have direct contact with students on school property during regular school hours or during school-sponsored activities have not been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child.

Contractor understands that, pursuant to Code of Virginia § 22.1-296.1, making a materially false statement regarding offenses which are required to be included in the certification referenced above is a Class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of the contract to provide such services and, when relevant, the revocation of any license required to provide such services. Staunton City Schools shall not be liable for materially false statements regarding the certifications required under this Contract.

It is certified, now and on a continuous basis, that none of our of directors, members, officers and none of our employees, or any person on our behalf who will have direct contact with students under this contract, has been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child.

_____

Contractor

By: _____

Name: _____

Title: _____

Date: _____

ATTACHMENT B

CERTIFICATION OF INTEREST & RELATIONSHIPS
WITH STAUNTON CITY SCHOOL BOARD AND STAUNTON CITY SCHOOL EMPLOYEES

Contractor hereby certifies that neither Contractor, nor any of Contractor's officers, directors, members or employees maintain a financial, business or familial relationship with any person acting for, or employed by or a member of the Staunton City School Board.

To the extent that such relationships exist, Contractor shall reveal the relationship below by describing the nature of the relationship and identifying the person with whom such relationship exists.

□ The following individuals currently maintain a ***financial or business*** relationship with Contractor.

School Board Member/SCS Employee's Name: _____

Position with School Board/Staunton City Schools: _____

Nature of Relationship: _____

_____

□ The following individuals currently maintain a ***familial*** relationship with Contractor.

School Board Member/SCS Employee's Name: _____

Position with School Board/Staunton City Schools: _____

Nature of Relationship: _____

_____

_____ _____

Contractor Date

By: _____

Name: _____

Title: _____

SECTION 000516 EMPLOYMENT VERIFICATION ACT

The provisions of this Section 000516 are prescribed by state or other law, and become part of the final agreement of the successful Bidder. By bidding on the Project, each Bidder signifies agreement to these provisions.

1. The Contractor and all subcontractors shall comply with applicable Federal and State (VPPA) rules, regulations, and processes regarding employment eligibility verification. Without limiting the foregoing, the Contractor shall submit to Owner or Architect, evidence of compliance with Federal and State (VPPA) employment eligibility verification rules and regulations, including submission of required Federal and State employment eligibility verification forms, at or prior to the time the Contract is executed. No Contract shall be formally awarded or executed unless the Contractor has complied with all applicable Federal and State employment eligibility verification rules. The Contractor shall ensure all subcontractors comply with Federal and State employment eligibility verification rules and regulations and obtain and submit all required employment eligibility verification forms from subcontractors.

2. Subcontracts between and among the Contractor and all subcontractors shall include a requirement that all parties thereto shall comply with applicable Federal and State (VPPA) employment eligibility verification rules and regulations, including a requirement that all parties submit required Federal and State employment eligibility verification forms.

3. The Contractor or Subcontractor shall be responsible for any penalties imposed for failure to comply with applicable Federal or State (VPPA) laws regarding employment eligibility verification.

END OF SECTION 000516

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

_____as Principal, and

_____as Surety, are hereby held and firmly bound unto _____as Owner in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this _____day of _____, 20____

The condition of the above obligation is such that whereas the Principal has submitted to _____ a certain bid attached hereto and hereby made a part of hereof to enter into a contract in writing, for the_____

_____

_____

NOW THEREFORE,

(a) If said Bid shall be rejected, or in the alternate

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in strict accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The surety for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____ (L.S.)
Principal

_____
Surety

By: _____

Seal

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that _____
_____
_____
(Insert full name or legal title and address of Contractor)

as Principal, hereinafter called Contractor,

and _____
_____
(Insert full name or legal title and address of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto _____
_____
_____
(Insert Name and Address of Owner)

as Obligee in the amount of: _____dollars ($_____)
(Insert sum equal to contract price in both words and figures)

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Contractor has by written agreement dated _____, 20____
entered into a Contract with Owner for:

SHELBURNE MIDDLE SCHOOL ADDITIONS AND RENOVATIONS
SCHOOL BOARD OF THE CITY OF STAUNTON, VA
Staunton, Virginia

in strict accordance with Drawings and Specifications as prepared by or for:

City of Staunton Engineering Department
116 West Beverley Street
Staunton, Virginia 24401

which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, in strict conformity with the Drawings, Specifications and Contract Documents, then this obligation shall be null and void. Otherwise, it shall remain in full force and effect for one (1) year after completion of all work:

a. The Surety hereby waives notice of any alternation or extension of time made by the Owner.

b. Any suit under this bond must be instituted, (1) before the expiration of one (1) year after completion of the Contract including the expiration of all warranties and guarantees, or (2) before the expiration of one (1) year after a defect or breach of warranty is discovered, if the action be for such.

c. No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the successors or assigns of Owner and every action brought hereon shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

SIGNED AND SEALED THIS _____day of _____, 20____

In the presence of:

_____(SEAL)
PRINCIPAL

_____
WITNESS

_____
BY TITLE

_____
SURETY

_____
WITNESS

_____
BY TITLE

Surety: (Attach power of attorney)

CONTRACTOR'S PERFORMANCE BOND
Project: _____

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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

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

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

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

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§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

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§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

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

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

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

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

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

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

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

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

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

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

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§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS [A201-2017 Article 11 language has been deleted in its entirety and replaced with language below]

§ 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

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.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.

(Paragraphs deleted)

§ 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.

(Paragraphs deleted)

§ 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.

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(Paragraph deleted)

§ 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.

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§ 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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a

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written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work,

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repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

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§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

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

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.3, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

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

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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SECTION 000750 SUPPLEMENTARY GENERAL CONDITIONS

The following supplements modify, change, delete from or add to the "**General Conditions of the Contract for Construction" AIA Document A201, 2017 Edition that was supplied with the invitation to bid**. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these Supplementary General Conditions, the unaltered provisions of the Article, Paragraph or Subparagraph shall remain in effect.

The General Conditions of the Contract for Construction may also be supplemented elsewhere in the Contract Documents.

ARTICLE 1 - GENERAL PROVISIONS
Paragraph 1.1 - Basic Definitions
Subparagraph 1.1.1 – The Contract Documents

DELETE the first sentence of Subparagraph 1.1.1 in its entirety and, in lieu thereof, substitute the following:

[*Substitute:*] The Contract Documents consist of documents enumerated in the Agreement between Owner and Contractor (hereinafter the Agreement) and also include of the Copyright, the Advertisement for Bids, Instructions to Bidders (AIA Document A701), Supplementary Instructions to Bidders, Bid Forms, Contractor's Qualification Statement (AIA Document A305), Non-Collusion Affidavit of Contractor, Standard Form of Agreement Between Owner and Contractor (AIA Document A101), Employment Verification Act, Affidavit Accepting Provisions of any applicable, Bid Bond, Performance & Payment Bonds, Conditions of the Contract (General, Supplementary and Special), City Of Staunton / VPPA Project Requirements / Federal Requirements (Section 000515), Employment Verification Act Provisions (Section 000516), List of Drawings, the Drawings, Specifications, all Addenda issued prior to execution of the Contract and all modifications thereto. Whenever used in a Contract Document, the term "Contract" or "Agreement" includes all exhibits to the Contract or Agreement.

DELETE the last sentence of Subparagraph 1.1.1 in its entirety.

Subparagraph 1.2.2 – The Contract

ADD the following to the end of the paragraph:

[*Add:*] "Each of the signatories below warrants and represents that he or she is authorized to bind the party on behalf of whom he or she is signing."

Subparagraph 1.1.3 – The Work

ADD the following to the end of the first sentence:

[*Add:*] "including any subcontractor's and sub-subcontractor's work and suppliers or any other entity for which Contractor is responsible and whether on or off the site of the Project."

Subparagraph 1.1.5 – The Drawings

ADD the following to the end of Subparagraph 1.1.5:

[*Add:*] "and shop drawings."

ADD the following new Subparagraphs:

1.1.9 The term "product" includes materials, systems and equipment.

1.1.10 The term "provide" includes furnishing and installing a product, complete in place, operating, tested and approved.

1.1.11 The term "building code" and the term "code" refer to regulations of governmental agencies having jurisdiction.

1.1.12 The terms "approved", "required" and "as directed" refer to and indicate the work or materials that may be approved, required or directed by Architect acting as the agent of Owner.

1.1.13 The term "similar" means in its general sense and not necessarily identical.

1.1.14 The terms "shown", "indicated", "detailed", "noted", "scheduled" and terms of similar import refer to requirements contained in the Contract Documents.

1.1.15 The terms "cost," "expense," or "fee" mean any amount paid or charged for something.

1.1.16 The term "including" also means including but not limited to the particular listing or description.

Paragraph 1.2 - Correlation and Intent of the Contract Documents

ADD the following new Subparagraphs:

1.2.4 Computed dimensions shall take precedence over scale dimensions, and large scale drawings shall take precedence over small scale drawings.

1.2.5 Anything shown on the Drawings and not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings shall have the same effect as if shown or mentioned respectively in both. Any work shown on one Drawing shall be construed to be shown in all Drawings, and Contractor shall coordinate the Work and Drawings to conform to the requirements of the Contract Documents.

1.2.6 In the event of conflict between different provisions in the Contract Documents, the provision calling for the higher quality or greater benefit to Owner shall prevail, unless Owner accepts in writing the provision calling for a lower quality or lesser benefit.

1.2.7 If any portion of the Contract Documents shall be in conflict with any other portion, after the application of the rules of interpretation set forth in this Paragraph 1.2, the various documents comprising the Contract Documents shall govern in the order of precedence as herein set forth according to their latest date of execution: (a) Change Orders submitted, processed and approved in accordance with applicable procedure; (b) written amendment to the various agreements (including but not limited to the Agreement) entered into or executed by Owner; (c) the various agreements entered into and executed by Owner, including but not limited to the Agreement (as modified by any Addenda thereto); (d) Addenda; (e) Supplementary Conditions (including Section 000515) (f) General Conditions; (g) Division 1 Specifications; (h) Instructions to Bidders; (i) Advertisement for Bids; (j) Bid Form; and (k) Drawings and Specifications. In the event of an inconsistency between the Specifications and Drawings, the interpretation as determined by Architect shall prevail subject to Subparagraph 1.2.5 above; as between large scale drawings and small scale drawings, the large scale drawings shall take precedence. Specifications having greater detail or specificity take priority over specifications of lesser detail or specificity and detail takes precedence over general drawings.

Paragraph 1.5 - Ownership and Use of Drawings, Specifications and Other Instruments of Service

ADD the following new Subparagraphs:

1.5.3 All reports, plans, specifications and computer files relating to this project (hereinafter the Instruments of Service) are the property of Crabtree, Rohrbaugh & Associates. Crabtree, Rohrbaugh & Associates retains all common law, statute and other reserved rights including the copyright thereto.

1.5.4 Except as provided in Section 000101, Sub-subparagraph 3.1.4.1, reproduction of the material herein or substantial use without written permission of Crabtree, Rohrbaugh & Associates violates the copyright laws of the United States and will be subject to legal prosecution.

Paragraph 1.6 – Notice
Subparagraph 1.6.1

ADD “reputable overnight delivery service” to the list of notice methods in Subparagraph 1.6.1.

DELETE the following from the end of the subparagraph and, in lieu thereof, SUBSTITUTE it as follows:

[*Delete:*] “if a method for electronic transmission is set forth in the Agreement.”

[*Substitute:*] “, if such electronic transmission is actually received by the individual for which it was intended. In addition, notice to the Contractor may be in the form of meeting minutes.”

ADD the following new sentence to the end of Subparagraph 1.6.1:

[*Add:*] Notice by mail shall be effective three (3) days after deposit in the mail, unless notice is received earlier.

Paragraph 1.7 – Digital Data Use and Transmission

DELETE Paragraph 1.7 in its entirety, and in lieu thereof, replace it with the following:

[*Replace*] "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 transmission, unless otherwise already provided in the Agreement or the Contract Documents."

Paragraph 1.8 – Building Information Models Use and Reliance

DELETE beginning in the second line "and without having those protocols…….. Project Building Information Modeling Protocol Form,"

ARTICLE 2 - OWNER

Paragraph 2.1 - General

Subparagraph 2.1.1

CHANGE the first part of the first sentence to identify Owner as follows:

School Board of the City of Staunton, Virginia
116 W Beverley St
Staunton, VA

Subparagraph 2.1.1

INSERT at the end of the second sentence ", except as may be provided otherwise in this Agreement."

Subparagraph 2.1.2

DELETE Subparagraph 2.1.2 in its entirety.

Paragraph 2.2 – Evidence of the Owner's Financial Arrangements

DELETE Paragraph 2.2, including all subparagraphs, in its entirety.

Paragraph 2.3 Information and Services Required of the Owner

Subparagraph 2.3.3

CHANGE "shall employ" to "may employ" in the first line.

DELETE "as to whom Contractor has no reasonable objection" from the second line.

Subparagraph 2.3.4

DELETE the last sentence in its entirety, and in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute*] "Contractor shall be responsible to verify the accuracy of the site's physical characteristics, legal limitations and utility locations and bring to the attention of Owner and Architect any discrepancies suspected or discovered that may affect the Work."

Subparagraph 2.3.5

INSERT at the beginning of the first sentence: "Upon written request from Contractor,"

Subparagraph 2.3.6

DELETE Subparagraph 2.3.6 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

2.3.6 The Prime Contractor(s) with whom Owner shall enter into a contract shall be entitled to receive up to three (3) sets of drawings and specifications without charge.

Paragraph 2.4 - Owner's Right to Stop the Work

DELETE the word "repeatedly" from the first sentence.

ADD the following to the end of the Subparagraph:

[*Add:*] "This right shall be in addition to and not in restriction of or derogation of Owner's rights under Article 14 hereof. Owner's right to stop the Work shall not relieve Contractor of its responsibilities and obligations under or pursuant to the Contract Documents. In the event an order by Owner to stop the Work is determined to be inappropriate, it shall not constitute a breach of Contract by Owner, but rather shall be a suspension of Work for the convenience of Owner.

Paragraph 2.5 - Owner's Right to Carry Out the Work

INSERT in the first line ", or fails under any circumstances" after "defaults or neglects" in the same such sentence.

REVISE the second line of the first sentence from "a ten-day period" to a "a seven-day period" and INSERT "or failure" after the repeated phrases "default or neglect."

DELETE the second sentence in its entirety and, in lieu thereof, SUBSTITUTE the following new sentence:

In such case, Owner shall have the right to deduct from payments then or thereafter due Contractor, the cost to Owner of correcting such default or neglect or failure, including Owner's

expenses and any fees or costs charged by contractors, consultants, experts, attorneys, Architect or Owner's Representative in connection with such corrective action.

ADD the following to the end of the Subparagraph:

[*Add:*] "Nothing contained herein shall obligate Owner to carry out work for the benefit of Contractor."

[*Add:*] "This right shall be in addition to and not in restriction of or derogation of Owner's rights under Article 14 hereof. Owners right to stop the Work shall not relieve Contractor of its responsibilities and obligations under or pursuant to the Contract Documents. *[Add:]* "Owner shall not be required to comply with the seven-day notice provision stated above, and shall have the right to immediately take any corrective action subject to the remaining provisions of this Paragraph 2.5, where providing such notice would impose risk of substantial disruption to the Project schedule or to the safety of any person or property, as determined in the sole discretion of Owner."

ADD new Paragraph 2.6 as follows:

Paragraph 2.6 – Owners Representative
Subparagraph 2.6.1

2.6.1 Owner's Representative during construction is Owner's designated and authorized representative to stop work for, including, but not limited to, unsatisfactory field test results, deficient materials, equipment or systems, deficient work or unsatisfactory installations. The following is a description of the services being provided by Owner's Representative to Owner and how Owner's Representative is to interact with Architect and Contractor. Owner's Representative shall assist Owner in observing performance of the work of Contractor. Owner's Representative shall endeavor to provide further protection for Owner against defects and deficiencies in the work of Contractor; but, furnishing of such services or taking any action will not make it responsible for or give them control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs, or responsibility for Contractor's failure to perform the Work in accordance strictly with the Contract Documents and in particular the specific limitations set forth in this Agreement as applicable. The duties and responsibilities of Owner's Representative are limited and described further as follows:

2.6.1.1 Owner's Representative is Owner's agent at the site and will act as directed by and under the supervision of Owner and will confer with Architect, Owner and Contractor, keeping Owner advised as necessary. Owner's Representative's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor. Owner's Representative shall generally communicate with Owner with the knowledge and under the direction of Owner.

2.6.1.2 Schedules: Review the progress schedule, schedule of shop drawing submittals and schedules of value prepared by Contractor and consult with Architect and Owner concerning acceptability and monitor Contractor's prepared Project Schedule and

Contractor's progress and conformance with project completion dates, pursuant to the schedule criteria.

2.6.1.3 Conferences and Meetings: Attend meetings with Architect and Contractors, such as Pre-Construction Conferences, Progress Meetings, Job Conferences, and other project-related meetings.

2.6.1.4 Liaison: Service as Owner's liaison with Contractor, and assist in understanding the intent of the Contract Documents; assist Architect and Owner in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.

2.6.1.5 Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

2.6.2 Shop Drawings and Samples:

2.6.2.1 Record date of receipt of Shop Drawings and Samples.

2.6.2.2 Receive samples which are furnished at the site by Contractor, and notify Architect and Owner of availability of samples for examination.

2.6.2.3 Advise Architect, Owner and Contractor of the commencement of any Work requiring a shop drawing or sample or if the submittal has not been approved by Architect and Owner.

2.6.3 Review of Work, Rejection of Defective Work, Inspections and Tests:

2.6.3.1 Conduct on-site observation of Work in progress to assist Architect and Owner in determining if the Work is, in general, proceeding in accordance with the Contract Documents.

2.6.3.2 Report to Architect and Owner whenever any Work is believed to be unsatisfactory, faulty, or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Architect and Owner of Work that is believed should be corrected or rejected or should be uncovered for observation or requires special testing, inspection or approval. Owner's Representative shall be officially designated to act on Owner's behalf as its authorized representative to exercise Owner's right to stop and/or suspend work or reject materials, equipment and systems or other non-conforming, deficient, incomplete and unacceptable work in complete accordance with AIA General Conditions, Article 2.3, provided in the Contract Documents by Architect.

2.6.3.3 Verify that all tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof; and observe, record, and report to Architect and Owner.

2.6.4 Interpretation of the Contract Documents: Report to Architect and Owner when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor any clarifications and interpretations as issued by Architect and Owner.

2.6.5 Modifications: Consider and evaluate Contractor's suggestions for modifications on Drawings or Specifications and report any recommendations to Architect and Owner. Transmit to Contractor decisions issued by Architect and Owner.

2.6.6 Records:

2.6.6.1 Maintain at the job site orderly files for correspondence, reports of Job Conferences, Shop Drawings and Samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional drawings issued subsequent to the execution of the Contract, Architect and Owner clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

2.6.6.2 Keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures and send copies to Architect and Owner.

2.6.6.3 Record names, addresses and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.

2.6.7 Reports:

2.6.7.1 Furnish Architect and Owner periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of shop drawing and sample submittals.

2.6.7.2 Consult with Architect and Owner in advance of scheduled major tests, inspections or start of important phases of the Work.

2.6.7.3 Draft proposed Change Orders and Work Directive Changes, obtaining backup material from Contractor and recommend to Architect and Owner, Change Orders, Work Directive Changes, and Field Orders.

2.6.7.4 Report immediately to Architect and Owner upon the occurrence of any accident.

2.6.8 Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedures for their submission and forward with recommendations to Architect and Owner, noting particularly the relationship of the payments requested to the Schedule of Values, Work completed and materials and equipment delivered at the site but not incorporated into the Work.

2.6.9 Certificates, Maintenance, and Operations Manuals: During the course of the Work, verify that certificates, maintenance and operations manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Owner prior to final payment for the Work.

2.6.10 Completion:

2.6.10.1 Before Architect and Owner issue a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

2.6.10.2 Conduct a final inspection in the company of Architect, Owner, and Contractor and prepare a final list of items to be completed or corrected.

2.6.10.3 Observe that all items on the final list have been completed or corrected and make recommendations to Architect and Owner concerning acceptance.

2.6.11 Owner's Representative - Limitations of Authority:

2.6.11.1 Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Architect and Owner.

2.6.11.2 Shall not exceed limitations of Architect and Owner's authority as set forth in the Agreement or the Contract Documents.

2.6.11.3 Shall not undertake or limit any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent.

2.6.11.4 Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction or safety unless such advice or directions are specifically required by the Contract Documents.

2.6.11.5 Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

2.6.11.6 Shall not accept Shop Drawings or Sample Submittals from anyone other than Contractor.

2.6.11.7 Shall not authorize Owner to occupy the Project in whole or in part.

2.6.11.8 Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Architect and Owner.

ARTICLE 3 - CONTRACTOR

Paragraph 3.1 - General

Subparagraph 3.1.1

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] "It shall be understood that the term "Contractor", as used throughout the General Conditions, applies to each Contractor entering into a Contract with Owner except where specifically noted otherwise."

Paragraph 3.2 - Review of Contract Documents and Field Conditions by Contractor

Subparagraph 3.2.2

DELETE the second sentence in its entirety and, in lieu thereof, SUBSTITUTE the following new sentences:

[*Substitute:*] "Contractor shall not be liable to Owner or Architect for any costs, fees or damage resulting from errors, inconsistencies or omissions in the Contract Documents unless Contractor should have reasonably recognized or suspected such error, inconsistency or omission and failed to report it immediately to Architect. Contractor warrants that Contractor has carefully studied

and reviewed the Contract Documents and that Contractor has reported any errors, inconsistencies or omissions to Architect. Contractor hereby acknowledges and declares that the Contract Documents are full and complete, are sufficient to have enabled Contractor to determine the cost of the Work and to fulfill all of Contractor's obligations under the Contract Documents. If Contractor encounters or suspects an error, inconsistency or omission, Contractor shall immediately submit it to Architect for resolution. If Contractor performs any construction activity knowing or having reason to know or suspect that it involves an error, inconsistency or omission, Contractor shall be responsible for such performance and shall bear the costs for correction. Contractor shall be liable to Owner for all costs and fees by consultants, experts, attorneys or Owner's Representative, and fees and costs for Additional Services of Architect (as defined in the Prime Agreement between Owner and Architect) to the extent that such fees and costs are caused by or arise from any deficient Work or the negligent acts or omissions or failure of Contractor. The Owner is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rule and regulations, but any nonconformity discovered or suspected by or made known to the Contractor shall be reported promptly to the Architect. The Contractor stipulates and agrees that the Owner has no duty to discover any design errors or omissions in the Drawings, Plans, Specifications and other Construction Documents and has no duty to notify Contractor of same. By entering into the Contract Documents or any agreement with any Architect, Owner does not warrant the adequacy and accuracy of any Drawings, Plans, Specifications or other Construction Documents.

Subparagraph 3.2.4

DELETE Subparagraph 3.2.4 in its entirety.

Paragraph 3.3 - Supervision and Construction Procedures
Subparagraph 3.3.2

ADD the following to the end of the last Subparagraph:

[*Add:*] "…or claiming by, through or under Contractor and for any damages, losses, costs and expenses resulting from such acts or omissions. If any failure by Contractor to comply with the Contract Documents or to maintain an approved project schedule causes any damage or costs to Owner, then Contractor shall indemnify and hold harmless Owner for any such damage or costs. Such damage or cost to Owner shall include any payment by Owner to others or liability of Owner to others resulting from such failure by Contractor, including but not limited to (1) any payment for liability arising from change orders, claims, or (2) any payment or liability for fees or costs to Owner's Representative, Architect, consultants, experts and attorneys.

Subparagraph 3.3.3

ADD the following new sentences to the end of the Subparagraph:

[*Add:*] "In the event Contractor discovers or suspects that portions of the Work related to another Prime Contractor's work are not in proper condition to receive subsequent work, Contractor shall notify Architect immediately of such. In the event Contractor fails to so notify Architect

immediately of such or otherwise fails to inspect previous Work in accordance herewith, and proceeds, Contractor shall be responsible for any such costs associated therewith.

ADD the following new Subparagraphs:

3.3.4 The General Contractor is designated as the Lead Contractor for this Project. Each Sub-Contractor shall coordinate its work with the work of the Lead and other Sub-Contractors. The Lead Contractor is responsible for making all coordination decisions not mutually agreed to by the affected Sub-Contractors. Disputes between the Lead Contractor and one or more Sub-Contractors and disputes between two or more Sub-Contractors pertaining to the creation, application, and modification of the Project Schedule, the furnishing of additional resources to meet the project schedule, job coordination, and all aspects of the coordination, means and methods of construction shall be submitted promptly to the Lead Contractor for a final construction decision. The final construction decision of the Lead Contractor must, at all times, be consistent with the content and intent of the Contract Documents. The final construction decision of the Lead Contractor shall be observed, accepted and fully followed by the Lead Contractor and all Sub-Contractors and their Subcontractors and Sub-subcontractors on the Project, subject only to the commencement of a proceeding pursuant to provisions of Article 15 at the request of the Lead Contractor or other Sub-Contractor. The progress of the Work in accordance with the final construction decision of the Lead Contractor shall not be delayed pending any proceeding pursuant to Article 15. The damage remedy in any Article 15 proceeding or dispute resolution proceeding in favor of the Lead Contractor or other Sub-Contractor shall be the exclusive remedy for disputes between or among Contractors. Contractors, including the Lead Contractor, shall have no right of action against Owner in connection with such disputes.

3.3.5 In the event any of the Work is required to be inspected or approved by any governmental authority having jurisdiction, Contractor shall cause such inspection or approval to be scheduled and performed. No inspection performed or failed to be performed shall release Contractor from its obligations to have such work inspected nor shall it be construed as an approval or acceptance of the Work or any part thereof.

3.3.6 Refer to Division 1, Section “Project Coordination” for detailed requirements regarding coordination of multiple prime contracts.

Paragraph 3.4 - Labor and Materials
Subparagraph 3.4.1

ADD the following new Sub-subparagraph to Subparagraph 3.4.1:

3.4.1.1 Refer to Division 1, Section “Temporary Facilities and Controls“, for detailed requirements regarding temporary utilities, services and facilities.

Subparagraph 3.4.2

DELETE Subparagraph 3.4.2 in its entirety, and in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.4.2 Refer to Division 1, Section "Substitutions", for additional requirements regarding substitutions.

Subparagraph 3.4.3

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] "Owner encourages but does not require that laborers and mechanics employed on the Project be residents of the City in which the work is being performed. Contractor shall be licensed in accordance with all applicable requirements of the Commonwealth of Virginia and the City of Staunton. Upon request of Owner, Contractor shall remove from the project any worker who is believed to be incompetent, careless or unsafe or is believed or suspected to put at risk the safety or welfare of any person or of the security of any property. The Contractor acknowledges that there may or will be students and employees of the Owner on or about the location where the Work is being performed and shall take affirmative precautions and institute specific safeguards to protect such persons at all times, including but not limited to conducting any update to background checks, and the use and display of photographic and name identification badges."

ADD the following new subparagraph:

3.4.4. The Contractor shall disclose in writing the existence and extent of any financial interests, whether direct or indirect, he has in subcontractors and material suppliers which he may propose for the Project.

Paragraph 3.5 – Warranty
Subparagraph 3.5.1

DELETE "inherent in the quality of the work the Contract Documents require or permit" from the second sentence.

DELETE the word "may" from the third sentence and replace it with "will".

ADD to the following to the end of the third sentence.

[*Add*] "unless Owner accepts in writing such nonconforming Work."

ADD the following new sentence to the end of the Subparagraph:

[*Add:*] "Contractor will fully secure and protect both new work and existing conditions during the period of construction which may be susceptible to damage or abuse or risk of loss in any regard.

ADD the following new Subparagraphs:

3.5.3 Contractor's warranty period shall be 1 year from the date of Substantial Completion of the Work and/or phase of the Work, except for specific items of work or equipment for which the warranty period is specified as a longer period elsewhere in the Contract Documents. Equipment and facilities which have seasonal limitations on their operation (e.g. heating or air conditioning units) shall be guaranteed for one (1) full year from the date of seasonally appropriate tests and acceptance, in writing, by the Owner. During the warranty period, Contractor shall promptly correct all defects which are due to defective materials or workmanship at no cost to Owner. Such correction shall extend to any other Work damaged or compromised by such correction.

3.5.4 At the end of the 11 month period from Substantial Completion from the commencement of the warranty period, Contractor shall schedule a walk-through inspection with Owner and Architect to identify any warranty items to be corrected under such warranty period.

3.5.5 Contractor shall be responsible for timely initiating and scheduling the eleven (11) month walk-through inspection contemplated in this warranty Section.

Paragraph 3.6 - Taxes

ADD the following new Subparagraph 3.6.1

3.6.1 Refer to Division 0, Section "Supplementary Instructions to Bidders", Article 10, regarding tax advantages for political subdivisions.

Paragraph 3.7 - Permits, Fees, Notices and Compliance with Laws
Subparagraph 3.7.1

DELETE Subparagraph 3.7.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

3.7.1 Contractor for General Construction shall secure the general building permit for the Project. Fees for this permit shall be paid directly by Owner.

Owner, through Architect, will submit drawings and specifications to the appropriate public authorities having jurisdiction, for approval. Owner will pay all fees for plan checking.

Subparagraph 3.7.3

INSERT "or suspecting" after "knowing" in the first line.

ADD the following new sentence to the end of Subparagraph 3.7.3:

[*Add:*] "Owner shall not be responsible for any inspection fees due to re-inspection of rejected work due to faulty or defective workmanship of Contractor, or scheduling error by Contractor.

Paragraph 3.7.4 – Concealed or Unknown Conditions

In the first sentence, strike “14” and substitute “3” before “days.”

Paragraph 3.8 - Allowances

DELETE Paragraph 3.8 in its entirety. No cash allowances are permitted.

Paragraph 3.9 – Superintendent

DELETE the final sentence of Subparagraph 3.9.3 and SUBSTITUTE the following:

[*Substitute:*] “The Contractor shall notify the Architect and Owner in writing of any proposed replacement of an incumbent Superintendent or Project Manager. The Contractor shall not voluntarily replace a Superintendent or Project Manager without prior written and discretionary approval from the Owner and Architect. The requirements contained in this Article shall apply to any proposed replacement Superintendent or Project Manager, regardless if the proposed tenure is to be temporary or permanent.”

Paragraph 3.10 - Contractor’s Construction and Submittal Schedules

ADD new Sub-subparagraph 3.10.1.1 as follows:

3.10.1.1 Refer to Division 1, Section “Construction Progress Documentation”, for further requirements regarding construction schedules.

Paragraph 3.11 - Documents and Samples at the Site

DELETE the last sentence of Paragraph 3.11 and, in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute:*] “These shall be in electronic form or paper copy, available to Architect and Owner, and shall be delivered to Owner, in good condition, upon completion of the Work, and before final payment is made.”

Paragraph 3.12 - Shop Drawings, Product Data and Samples
Subparagraph 3.12.4

ADD the following new Sub-sub paragraphs:

3.12.4.1 Issuance of the Design Professional’s Instruments of Service via electronic media in either .dwf or .dwg file format, hereinafter referred to as “Media” will be provided at the request of Contractor. This Media is provided without detail and dimensions and is for illustrative purposes only and does not amend, supplement or replace any drawing, Contract Document, Specification and/or in any way, the Contract requirements of such. The purpose of this Media is solely for coordination by Contractor and shall not be relied upon for any other purpose. Contractor fully releases the Design Professional, its agents, officers, and employees, and consultants,

from any and all liability, including without limitation, damages, consequential damages, costs and attorney's fees that Contractor may incur as a result of its reliance on the information contained in the Media.

3.12.4.2 In accepting and utilizing Media provided by the Design Professional, Contractor covenants and agrees that all such Media are instruments of service between the Design Professional and the client of the Design Professional, who shall be deemed the author of the Media, and the Design Professional shall retain all common law, statutory law and other rights, including copyrights, whether or not such copyright is registered. Contractor acknowledges that the information and designs contained on the Media are provided to Contractor as a convenience and at the request of Contractor. Contractor also acknowledges that there may be undiscovered errors or inconsistencies in the Media that may result from any number of issues, including migrating the data from printed material to the Media or from others adding information to, or changing information in, the Media once transmitted to Contractor. Contractor agrees not to hold the Design Professional responsible for any defects Contractor may discover with the Media or information contained in the Media.

3.12.4.3 Contractor agrees not to use the Media, in whole or in part, for any purpose or project other than the Project of this Contract. Contractor agrees to waive all claims against the Design Professional resulting in any way from use of the Media.

3.12.4.4 Contractor agrees, to the fullest extent permitted by law, to defend, release, indemnify and hold the Design Professional harmless from and against any and all claims, damage, loss, liability or cost, including reasonable attorney's fees and costs of defense, arising out of or resulting from any changes made by anyone other than the Design Professional, or from any reuse of the Media, and data contained on the Media without the prior written consent of the Design Professional.

3.12.4.5 Contractor recognizes that information contained on the Media may not be 100% compatible with Contractor's computer system; therefore, Contractor agrees that the Design Professional shall not be liable for the completeness or accuracy of any materials provided on the Media arising out of, due to, or resulting from the difference in computer and software systems, or translations or mistranslation of electronic data, the incompatibility of viewing or operating programs, or the corruption of documents or data as a result of compatibility issues.

3.12.4.6 Contractor recognizes that information stored on electronic media including, but not limited to, computer disks may be subject to undetectable alteration and/or uncontrollable deterioration, due to, among other causes, errors in transmission, conversion, media degradation, software error or human error or alteration. Accordingly, the Media is provided for informational purposes only and is not intended as an end-product. Contractor therefore agrees that the Design Professional shall not be liable for the completeness or accuracy of any materials provided on the Media for this or any other reason whatsoever.

3.12.4.7 Under no circumstances shall the transfer of instruments of service in electronic media, for use by Contractor, be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose of the electronic media, or the information stored or contained thereon. Contractor acknowledges that the Media is provided as a convenience by the Design Professional at Contractor's request, and

Contractor assumes all risk in the use of the Media, and the data contained therein for any purpose. Contractor further acknowledges that the Design Professional was not engaged to provide usable electronic data, or a usable system, compilation, Model or program to Contractor or any other party. Contractor agrees that the Design Professional shall not be liable in any manner whatsoever for any subsequent usage of the data provided on electronic media.

3.12.4.8 Contractor agrees that in the event of a conflict between non-electronic data and data provided on the Media, including but not limited to the Model, the data contained on non-electronic documents presides over data on the Media. While the Design Professional has made a reasonable effort in accordance with the generally accepted standards of professional skill and care so that the data contained on the Media is accurate, the Design Professional makes no representation or warranty concerning the accuracy of the data contained on the Media, or any viruses contained in the materials as delivered or any other defect or error or alleged defect or error in the materials as delivered.

3.12.4.9 Contractor, by submitting a Bid and requesting electronic media from the Design Professional, accepts all terms of use of the Media as stated herein. Media will be provided to Contractor, upon Contractor's request, and upon remittance of payment to the following schedule:

- 1 to 10 Sheets as they appear in the Contract Documents - $100
- 11 to 20 Sheets as they appear in the Contract Documents - $200
- 21 to 30 Sheets as they appear in the Contract Documents - $300
- 31 to 40 Sheets as they appear in the Contract Documents - $400

The above costs apply to Architectural sheets only. The cost for electronic files for the engineering disciplines may vary. The Engineer of Record, as the author of the engineering drawings, shall be contacted directly for cost information, and the procedures for requesting their electronic media.

Subparagraph 3.12.10

ADD ", but if the Contractor becomes aware of any inadequacy or inaccuracy in such Contract Documents, he shall bring such inadequacy or inaccuracy to the attention of the Architect." after "The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents".

ADD new Subparagraph 3.12.11 as follows:

3.12.11 Refer to Division 1, Section "Submittals", for further requirements regarding shop drawings, product data and samples.

Paragraph 3.13 Use of Site
Subparagraph 3.13.1

ADD new Subparagraph 3.13.1 as follows:

3.13.1 Control or Reference Points: Immediately upon occupancy of the project site for the purpose of commencement of the Work, Contractor shall locate, including but not limited to, all general control or reference points, benchmarks, etc., and take such action as may be necessary to prevent damage or destruction of such points. In the event Contractor fails to do so, Contractor shall be liable for all such costs, including but not limited to professional fees and costs, necessary to re-establish such control or reference points.

Paragraph 3.14 - Cutting and Patching

DELETE Paragraph 3.14, including all subparagraphs, in its entirety, and in lieu thereof, SUBSTITUTE it with the following new Paragraph:

3.14 Refer to Division 1, Section "Cutting and Patching", for requirements regarding cutting and patching.

Paragraph 3.15 Cleaning Up
Subparagraph 3.15.1

ADD new Subparagraph 3.15.3 as follows:

3.15.3 Refer to Division 1, Section "Contract Closeout", for further requirements regarding cleaning up.

Paragraph 3.18 Indemnification
Subparagraph 3.18.1

ADD ", defend, " after the word "indemnify" and "of any kind" after the word "expenses" in the first sentence.

ADD "Contractor's breach of any obligation or warranty under this Agreement, or from " after the word "from" on line 3.

DELETE "negligent" before the phrase "acts or omissions" in the first sentence.

DELETE "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)" from the first sentence.

ADD the following to the end of the subparagraph:

[*Add:*] Contractor's indemnification obligation shall not apply when the claim, damage, loss, or expense is caused by the sole negligence of the Owner or its employees. This indemnity agreement shall impose liability on the Contactor to the fullest extent permitted by the laws of Virginia, and any provision hereof not permitted by such laws is expressly deleted from said agreement. For the avoidance of doubt, the acts or omissions described in (b) above shall include, without limitation, (i) any act or omission of a person described in providing supervisory,

inspection or engineering services, (ii) any act or omission of a Performing Party in connection with any design, application, professional advice or opinion rendered to the Owner or on the Owner's behalf, and (iii) any act or omission of a Performing Party in connection with the use or misuse of any substance, material, machinery, hoist, rigging, block, scaffolding, or any and all kinds of equipment whether or not owned, furnished or lent by the Owner."

ADD the following new subparagraphs as follows:

3.18.3 In the event of accidents involving personal injury or property damage, the Contractor shall immediately notify the Owner, furnishing as much data as is available. As soon as practicable, Contractor shall furnish to the Owner a written report indicating the extent of the damage, the persons involved, the employer of the persons involved and the number of days each person is hospitalized. Notification of any accident shall not relieve the Contractor of its obligations regarding safety for the Project.

3.18.4 The purchase of insurance by the Contractor shall in no event be construed as a fulfillment or discharge of the obligations set forth in this section.

3.18.5 Where the facts or the law relating to any threatened or actual claim would preclude the Indemnified Party from being completely indemnified, the indemnified party will be partially indemnified by the indemnifying party to the fullest extent permitted by the law.

ADD the following new Paragraphs as follows:

3.19 Contractor shall indemnify and hold harmless Owner for any additional fee, cost or expense (beyond a base fee) charged to Owner by Architect or other project consultant pursuant to its own agreement with Owner to the extent such additional fee, cost or expense is caused by Contractor's acts or omissions.

3.20 Owner may deduct amounts owed by Contractor pursuant to Paragraph 3.18 or 3.19 from payments otherwise due to Contractor, and upon request of Owner shall provide Contractor a copy of the written agreement regarding such additional fee, cost or expense payment.

ARTICLE 4 - ARCHITECT

Paragraph 4.1 - General

Subparagraph 4.1.2

DELETE the word "Contractor" from the second line.

Paragraph 4.2 – Administration of the Contract

Subparagraph 4.2.3

INSERT "or suspected" before "deviations" and INSERT "or suspected" after "observed" each time such words occur in the first sentence.

Subparagraph 4.2.4

DELETE the first and second sentences in their entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "Owner and Contractor shall endeavor to communicate with each other through Architect about matters arising out of or relating to the Contract."

Subparagraph 4.2.5

ADD to the end of the subparagraph, the following:

[*Add:*] ", with Certificates for Payment being subject to Owner approval."

Subparagraph 4.2.6

ADD the following to the end of the first sentence.

[Add:] "and shall do so unless Owner accepts, in writing, such nonconforming work"

Subparagraph 4.2.8

Add new Sub-subparagraph as follows:

4.2.8.1 No change in the Work will give rise to an increase in the Contract Sum without a Change Order expressly providing for such increase, and that the Contractor waives any claim for such an increase based upon unjust enrichment, course of dealings or implied or express acceptance.

Subparagraph 4.2.9

ADD after "Certificates of Substantial Completion" AND after "a final Certificate for Payment", both in the first sentence, the following:

[*Add:*] "subject to Owner approval,"

ARTICLE 5 – SUBCONTRACTORS
Paragraph 5.2 - Award of Subcontracts and Other Contracts for Portions of the Work
Subparagraph 5.2.1

DELETE the first sentence of Subparagraph 5.2.1 and, in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute:*] "Within fourteen (14) days after the award of the Contract, Contractor shall notify Owner and Architect, in writing, the names of the persons or entities, including those who are to

furnish materials or equipment fabricated to a special design, proposed for each of the principal portions of the Work.

Subparagraph 5.2.3

DELETE the second and third sentences in their entirety and, in lieu thereof, SUBSTITUTE the following:

[Substitute:] "In the event of any such objection, Contractor shall not contract with the proposed person or entity, and there shall be no increase in the Contract Sum or Contract Time."

ADD new Paragraph 5.5 as follows:

Paragraph 5.5 - Payment to Subcontractors

5.5.1 Contractor shall pay each subcontractor, upon receipt of payment from Owner, an amount equal to the percentage of completion allowed to Contractor on account of such subcontractor's Work, less the percentage retained from payments to Contractor; PROVIDED, however, that Contractor shall make no payment to any subcontractor unless the subcontractor shall execute a waiver of liens in favor of Owner and Contractor reflecting the amount of each such payment. Contractor shall also require each subcontractor to make similar payments to sub-subcontractors. All such payments shall be paid within the time limits required by the Commonwealth of Virginia – VPPA, and shall be subject to the provisions contained in Section 000515.

5.5.2 If Owner fails to approve an Application for Payment for a cause which Owner and Architect determine is the fault of Contractor and not the fault of a particular subcontractor, or if Contractor fails to make payment which is properly due to a particular subcontractor, Owner may pay such subcontractor directly, less the amount to be retained under its Subcontract. Any amount so paid by Owner shall be repaid to Owner by Contractor. Owner shall have no obligation to pay or to see to the payment of any monies to any subcontractor. Nothing contained in Paragraph 5.5 shall be deemed to create any contractual relationship between Owner and any subcontractor or to create any rights in any subcontractor against Owner. Contractor shall promptly advise Owner of any claim or demand by a subcontractor claiming that any amount is due to such subcontractor or claiming any default by Contractor in any of its obligations to such subcontractor.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Paragraph 6.1 – Owners Right to Perform Construction and to Award Separate Contracts

DELETE "and waiver of subrogation" in Subparagaph 6.1.1.

DELETE Subparagraph 6.1.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

6.1.3 It is the sole duty and responsibility of the Contractor to plan, direct, perform and coordinate its Work as to cause no delay, hindrance, loss, injury, or similar damage to subcontractors or material suppliers. In the event the Contractor causes any delay, hindrance, loss, injury, or similar damage to subcontractors or material suppliers, the aggrieved subcontractors or material suppliers may pursue recovery of money damages against the Contractor pursuant to Article 15. There shall be no claim asserted against the Owner or the Architect, or their respective directors, employees or agents for money damages based on the alleged acts or omissions with respect to coordinating, expediting or directing the Work. If the Contractor prosecutes a claim against the Owner or the Architect for money damages or for an alleged failure to coordinate, expedite or direct the Work, then the Contractor shall indemnify and hold harmless the Owner and the Architect against any and all costs, losses or expenses, including consulting, expert, counsel fees, that the Owner or the Architect incur in responding to any such claim plus 10% interest per annum on all such costs from the date of occurrence of such costs up to the date of payment.

Paragraph 6.2 – Mutual Responsibility

Subparagraph 6.2.2

INSERT "or suspected" before "apparent" in the first, second, and third sentences.

Subparagraph 6.2.3

DELETE the second sentence of Subparagraph 6.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new sentence:

[*Substitute:*] "Costs caused by delays, or by improperly timed activities or defective construction shall be borne by the responsible party therefore. Contractor shall indemnify Owner for any costs, damages or payments Owner incurs (including any payments to other contractors, Architect, legal counsel, agents or consultants) arising from or relating to Work by Contractor that is not in compliance with the Contract Documents. Owner may withhold payments otherwise due to Contractor in the event of such indemnification duty.

ADD the following new sentence to the end of Subparagraph 6.2.4:

[*Add:*] "Contractor agrees to indemnify and hold Owner and Architect harmless for any claims or damages brought by a separate contractor arising out of the actions or omissions of Contractor, its subcontractors or suppliers in performing their work under the Contract Documents.

ARTICLE 7 - CHANGES IN THE WORK

Paragraph 7.1 – General

Subparagraph 7.1.1

INSERT “and applicable law” after the word “Documents” at the end of the sentence.

Subparagraph 7.1.2

REVISE the first part of the first sentence of Subparagraph 7.1.2 to read as follows:

[*Revise:*] “A Change Order shall be based upon agreement between Owner and Contractor; a Construction Change Directive ……..”

Subparagraph 7.1.3

DELETE Subparagraph 7.1.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.1.3 Before any Change Order is prepared, Contractor shall submit to Architect, in writing, an itemized breakdown of the cost of the proposed Change in the Work. The term “cost” shall be interpreted to mean and include the actual, verified incremental cost of the following:

1. Labor, including foremen.
2. Materials at cost plus applicable taxes entering permanently into the Work.
3. Rental cost of construction plant and equipment, whether rented from Contractor or others.
4. Power and consumable supplies for the operation of power equipment.
5. Liability insurance and bonds.
6. Social security, old age and unemployment contributions.

When determining the labor costs of Work by Change Order, Contractor shall use the actual wage paid to the personnel performing the Work, and if requested by Owner or Architect, at any time during or after the project, Contractor shall provide certified payroll records necessary to evidence those labor costs. Using the actual wage paid to the personnel performing the Work, Contractor shall be entitled to fifteen percent (15%) of the total cost of the above for overhead, profit, supervision and miscellaneous expenses if they perform the Work with their own forces, or to the Subcontractor who performs the Work. In the case where the Work is performed by a subcontractor, Contractor may add five percent (5%) to the Subcontractor’s total amount as Contractor’s commission. Where Change Orders include both increases and decreases in the Contract Amount, the above fifteen percent (15%) will be allowed on the net increase only.

Paragraph 7.2 - Change Orders
Subparagraph 7.2.1

DELETE Subparagraph 7.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

7.2.1 A Change Order is a written instrument prepared by Architect and signed by Owner, Contractor and Architect. A Change Order is the only method by which the Contract Sum

and/or the Contract Time may be adjusted. A Change Order shall provide for the following: (1) a change in the Work, if any; (2) the amount of the adjustment in the Contract Sum, if any; and (3) the extent of the adjustment in the Contract Time, if any.

ADD the following new Subparagraphs:

7.2.2 Contractor is responsible for submitting verified accurate cost and pricing data to support its proposals for change orders and other Contract price adjustments under the Contract Documents. Contractor shall certify in writing that to the best of its knowledge and belief, the cost and pricing data submitted is accurate, complete, current and in accordance with the terms of the Contract Documents with respect to pricing of change orders. Contractor shall also certify in writing that he has made reasonable good faith inquiries to appropriate individuals within its organization to confirm that the data submitted is net of all discounts, rebates, savings, and other reductions and is accurate, complete and current. The above-described certification shall be required for all change order requests with a positive or negative value greater than $1,000.00. If it is later determined by audit or by other means that the cost and pricing data submitted is not net of all discounts, rebates, savings, and other reductions, inaccurate, incomplete, not current or not in compliance with the terms of the Contract Documents regarding the pricing of change orders, then an appropriate contract price reduction shall be made.

7.2.3 Contractor shall perform the work of Change Orders only with personnel appropriate for the tasks performed. Should Contractor use overqualified personnel, Contractor shall only be entitled to payment for the work at the wage rate of the appropriate personnel, plus the applicable multipliers noted in 7.1.3.

7.2.4 Any Contractor creating the need for Additional Services by Architect, with respect to a Change Order, shall pay all costs associated with such Additional Services, and Architect shall prepare and present to Owner for approval, a Change Order or Construction Change Directive regarding such costs.

Paragraph 7.3 – Construction Change Directives
Subparagraph 7.3.2

ADD new Sub-subparagraph 7.3.2.1 as follows:

7.3.2.1 Any Contractor creating the need for Additional Services by Architect, with respect to a Construction Change Directive, shall pay all costs associated with such Additional Services, and Architect shall prepare and present to Owner for approval, a Change Order or Construction Change Directive regarding such costs.

ARTICLE 8 - TIME
Paragraph 8.1 – Definitions
Subparagraph 8.1.3

INSERT after “Architect”, the following:

[*Insert:*] "and approved by Owner"

Subparagraph 8.2.2

INSERT "and submission to the Owner of certificates" after "date" in the sentence.

Paragraph 8.3 – Delays and Extensions of Time
Subparagraph 8.3.1

DELETE (3) in its entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "(3) by fire or adverse weather conditions documented in accordance with Section 15.1.6."

DELETE (4) in its entirety and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] "(4) by delay authorized by Owner pending a proceeding pursuant to Article 15; or"

ADD the following new sentences to the end of Subparagraph 8.3.1:

[*Add:*] "All claims for extension of time shall be made, in writing, to Architect and Owner no more than seven (7) days after the occurrence of the event causing the delay. If an extension of the Contract Time for a contractor is granted due to neglect, misconduct or failure to comply with the Contract Documents by another contractor and such delay causes any contractor to miss a Milestone in the Project Schedule, then liquidated damages for delay pursuant to Paragraph 8.4, caused by the delay, shall be applied against Contractor responsible for having caused such extension of the Contract Time. A contractor causing Project delay shall be liable for and reimburse Owner for all costs, including any additional fees to Architect resulting from such delay.

Subparagraph 8.3.3

DELETE Subparagraph 8.3.3 in its entirety and, in lieu thereof, SUBSTITUTE the following:

8.3.3 Contractor recognizes that delays, acceleration or hindrances to the Work may occur. To the fullest extent permitted by law, no claim or litigation for increased costs, charges, expenses or damages of any kind shall be filed by Contractor against Owner, Architect or Owner's Representative (or against any of their respective employees or agents) for any delays, acceleration, hindrances, or sequencing of work due to any cause whatsoever, notwithstanding whether such delays are caused by factors within or outside Contractor's control. Contractor's sole remedy for delays, acceleration, hindrances or sequencing of work (except against a responsible contractor pursuant to subparagraphs 3.3.4 and 6.1.3) shall be an extension of the Contract Time pursuant to this Paragraph 8.3. No additional compensation will be allowed for time extensions (including time extensions based on weather). Should Contractor file any claim or litigation for money damages against Owner, Architect or Owner's Representative (including their employees or agents) contrary to this provision, such contractor shall pay all costs imposed or permitted by law to be recovered, including as allowed indemnification for any costs incurred as to such

claim and all fees by consultants, experts, and attorneys, plus 10% interest per annum on all such costs from the date of occurrence of such costs up to the date of payment.

ADD new Paragraph 8.4 as follows:

Paragraph 8.4 – Liquidated Damages for Delays

8.4.1 Owner and Contractor stipulate that delay by the Contractor in completion would have significant adverse consequences for the Project; that, however, the actual damages to Owner from such delay are uncertain and would be impossible and not susceptible to reasonable determination; and that liquidated damages of such failure by Contractor to perform in a timely manner are a reasonable way and not a penalty to address such adverse consequences. Contractor also stipulates that it shall not challenge, either directly or indirectly, this liquidated damages provision. Owner, therefore, may require Contractor to pay liquidated damages of $1,500 per day for the Contractor's failure to perform timely in strict accordance with the Contract. **The amount of Liquidated Damages shall be $1,500 per day, per phase.**

8.4.2 If, during the course of Contractor's performance of the Work, Contractor shall fail to complete the Work, or portions thereof, in accordance with Specific Dates or the Contract Time, Owner may retain the amount of liquidated damages for which Contractor shall be liable to Owner under the Contract Documents, from amounts which become payable or are otherwise certified as payable to Contractor under the Contract Documents.

8.4.3 In the event that the Work must be conducted beyond the normal working hours specified or if the Project is not completed within the specified duration, Contractor shall indemnify Owner for any costs, damages or payments incurred by Owner, including payments to the Owner's Representative, Architect, , consultants, experts, or legal counsel.

8.4.4 If Contractor files any claim or litigation challenging an assessment of liquidated damages, or the daily or total amount of liquidated damages assessed, and does not prevail completely in such challenge, Contractor shall be liable to Owner for all costs incurred by Owner in defending against the challenge, including all fees and costs of the attorneys, experts, architects, and other consultants, and all costs related to the time of the Owner's Representative, Owner's staff and administrators based on the applicable compensation rates.

ARTICLE 9 - PAYMENTS AND COMPLETION

Paragraph 9.1 Contract Sum
Subparagraph 9.1.2

ADD the following new Sub-subparagraphs:

9.1.2.1 Owner reserves the right to accept or reject any and all Unit Prices stipulated on the Bid Form.

9.1.2.2 If quantities originally contemplated are materially changed so that application of a unit price will cause a substantial inequity to Owner the Owner reserves the right to equitably adjust the Unit Price or to require that the work be performed on a time and material basis.

Paragraph 9.2 – Schedule of Values

ADD new Subparagraph 9.2.1 as follows:

9.2.1 Refer to Division 1 Section, "Applications for Payment" for requirements regarding the schedule of values.

ADD new Subparagraph 9.2.2 as follows:

9.2.2 The Schedule of Values shall be prepared in such a manner that each major item of Work and each subcontracted item of Work is shown as a line item on AIA Document G703, Application and Certificate for Payment Continuation Sheet. Each major item of Work shall be further broken down into separate line items for work done in each area of the building, site and each phase of construction. Each work item shall be broken down into separate line items for material and labor. Each line item shall include quantities and unit prices in such detail as required by Architect.

Paragraph 9.3 - Applications for Payment
Subparagraph 9.3.1

DELETE Subparagraph 9.3.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

9.3.1 At least fifteen (15) days before the date established for each progress payment, Contractor shall submit to Architect an itemized Application for Payment for Work completed in accordance with the Contract Documents. Such application shall be notarized and supported by such data substantiating Contractor's right to payment as Owner or Architect may require, such as copies of requisitions, and releases and waivers of liens from subcontractors and suppliers and reflecting retainage.

Notwithstanding the language in §9.10.5 or any other section hereof, before Owner shall have any obligation to release any payments for Work completed to Contractor, Contractor shall deliver an executed and notarized "Partial Waiver and Release of Mechanics Lien Claims" in the form provided. The partial waiver of liens shall waive Contractor's right to file a lien against the Property or Owner for an amount equal to the payment received by Contractor at that time.

Contractor shall obtain and post a bond guaranteeing payment for labor and materials provided by subcontractors in an amount, form and a surety acceptable to Owner and in compliance with applicable law.

Contractor hereby agrees that it will defend, indemnify and hold harmless Owner from and against any subcontractor's labor or materials claims, mechanics' lien or any other claim or proceeding filed by any subcontractor by reason of Contractor's failure to pay the Subcontractor any amount owed to such Subcontractor. Although this Project is a public entity project and not subject to the assertion of liens under applicable law, Contractor shall prevent the filing of any mechanics' lien, or should a lien be filed, Contractor shall undertake any and all action necessary to remove said lien or cloud on title. Any failure of Contractor in any of its obligations in this § 9.3.1 shall constitute a material breach of this Contract. Furthermore, Contractor shall be obligated to pay Owner all of Owner's costs incurred in defending or removing any such mechanics' lien whether filed by Contractor or any subcontractor. This shall include payment of all of Owner's attorney's fees, whether incurred in removing any cloud or challenging any mechanics' lien claim filed by Contractor or any subcontractor, or in enforcing Contractor's obligations hereunder.

Owner shall retain five percent (5%) of all amounts due Contractor until the Work is substantially complete and the punch list is complete and deemed satisfactory by the Architect and Owner's Representative. The retained percentage will be paid with the final Payment or as otherwise provided hereafter. In the event a dispute arises between Owner and Contractor, which dispute is based upon increased costs claimed by Contractor occasioned by damages or other actions of another contractor, additional retainage, in the sum of one and one half times the amount of any possible liability, may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless Contractor causing the additional claim furnishes an additional bond satisfactory to Owner to indemnify Owner against the claim.

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

ADD new Sub-subparagraph 9.3.1.3 as follows:

9.3.1.3 Refer to Division 1 Section "Applications for Payment" for additional requirements regarding applications for payment.

DELETE the second sentence and the word "Payment" from the beginning of the third sentence in Subparagraph 9.3.2, and SUBSTITUTE in its place the following:

[*Substitute:*] "When an application for payment includes products stored off the project site or stored on the project site but not incorporated in the Project, for which no previous payment has been requested, a complete description of such product shall be attached to the application. Suitable storage which is off the project site shall be a bonded warehouse with the stored products properly tagged and identifiable for the Project. The Owner's written approval shall be obtained before the use of an off-site storage is made. If the size, quantity, and/or type of material or product is such that a bonded warehouse is deemed unsuitable, then, with the Owner's approval, the Contractor may elect to store certain products on his premises, or to

repay a subcontractor or supplier for certain material and products which are to remain on and be stored on the subcontractor's or supplier's premises until needed by the project. In such event, the Contractor shall enter into a security agreement with the subcontractor or supplier under which the Contractor shall be granted a security interest in and to all such material and products fabricated and/or to be supplied by the subcontractor or supplier for this Project and stored on the subcontractor's or supplier's premises. All expenses incurred in this agreement be the responsibility of the Contractor. A copy of each and every agreement shall be filed with the Architect with the first application for payment which requests payment for such material or products. In any event, payment…"

Paragraph 9.5 - Decisions to Withhold Certification
Subparagraph 9.5.1

DELETE the first sentence of Subparagraph 9.5.1 and, in lieu thereof, SUBSTITUTE it with the following:

[*Substitute:*] "Architect shall not certify payment and shall withhold a Certificate for Payment in whole or in part to the extent necessary to protect Owner."

REVISE the following Sub-subparagraphs as follows:

9.5.1.7 DELETE the word "repeated".

ADD the following new Sub-subparagraphs:

9.5.1.8 Unsatisfactory prosecution of the Work in strict accordance with the Contract Documents.
9.5.1.9 Failure to comply with any statute, ordinance regulation or other legal requirement.
9.5.1.10 Failure to submit progress schedule updates as required by the Contract Documents.
9.5.1.11 Failure to submit wage certification as required by the Contract Documents.
9.5.1.12 Failure to submit a Schedule of Values that is acceptable to Architect.

Add a new Sub-subparagraph 9.5.2.1 as follows:

9.5.2.1 The Owner shall not be in breach for withholding payment so long as it does so in good faith based upon a bona fide dispute. The Contractor may not stop work during the pendency of a bona fide dispute. Until the dispute is resolved, the associated sum shall be placed in escrow.

Paragraph 9.6 – Progress Payments
Subparagraph 9.6.1

ADD "and Owner has approved" AFTER "the Architect has issued," AND DELETE "and shall so notify the Architect."

Subparagraph 9.6.2

DELETE Subparagraph 9.6.2 in its entirety. Provisions regarding payment of subcontractors, as required under state law, are located in paragraph 1.7 of Section 000515.

Subparagraph 9.6.7

DELETE Subparagraph 9.6.7 in its entirety.

Paragraph 9.7

INSERT “written” before “notice” (first sentence, fourth line).

Paragraph 9.8 – Substantial Completion
Subparagraph 9.8.1

DELETE Subparagraph 9.8.1 in its entirety and, in lieu thereof, SUBSTITUTE it with the following:

9.8.1 Substantial Completion of Project shall be deemed to occur when Architect determines and Owner approves that the Work, or designated phase thereof, is sufficiently complete in accordance with the Contract Documents so Owner can occupy and utilize the Work for its intended use, and in addition, all requirements of the Contract Documents for Substantial Completion have been fulfilled. Substantial Completion shall not have occurred unless all systems are operational, all systems have been tested and passed inspection, all facility inspections have been conducted and passed, all certifications have been posted, all personnel instruction is complete, all required finishes are in place, and any remaining work will not hamper or impair or compromise school operations.

Subparagraph 9.8.2

DELETE the words “prior to final payment.” from the third line and, in lieu thereof, SUBSTITUTE the following:

[*Substitute:*] “within 30 days of the date of Substantial Completion.”

ADD new Sub-subparagraph 9.8.2.1 as follows:

9.8.2.1 Definition: Contractor’s comprehensive list of items to be completed or corrected shall be referred to as the “Punch List.” The Punch List shall be prepared by Contractor on the form provided in Division 1 Section “Contract Closeout”, or in an electronic format acceptable to Architect, (i.e., Bluebeam, PlanGrid, etc.,)

Subparagraph 9.8.5

ADD new Sub-subparagraph 9.8.5.1 as follows:

9.8.5.1 Owner’s retainage upon Substantial Completion shall be the greater of (a) 5% of the Contract Sum adjusted by Change Orders, or (b) the amount necessary to protect Owner’s interests, a minimum of 150% of Architect’s estimated cost to complete or correct Work at the time of Substantial Completion.

Paragraph 9.10 - Final Completion and Final Payment

Subparagraph 9.10.1

INSERT “written” before the word “notice” in the first sentence.

Subparagraph 9.10.2

ADD after the words “shall become due until” in the first sentence, “Owner approves such payment and”

ADD new Subsections (7) and (8) to the end of the first sentence:

[*Add:*] “(7) Final as-built prints of record drawings marked by Contractor with record information as set forth in the Contract Documents, and (8) A final, unconditional sworn statement from Contractor duly executed and acknowledged showing all subcontractors to be fully paid and similar, final unconditional sworn statements from subcontractors and, when appropriate, from sub-subcontractors.

Subparagraph 9.10.3

INSERT “any” before “Claims” (last word in the sentence).

Subparagraph 9.10.4

ADD the following new Sub-subparagraphs:

9.10.4.5 Latent failures of Contractor to comply with the requirements of the Contract Documents.

9.10.4.6 Architect’s fees resulting from re-inspections due to Contractor’s failure to satisfactorily, fully and finally complete the Work or legal and accounting costs and expenses arising therefrom.

9.10.4.7 Architectural fees for services (60) days after the date of Substantial Completion shall be borne by the responsible contractor.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

Paragraph 10.2 - Safety of Persons and Property

Subparagraph 10.2.1

INSERT at the beginning of the sentence the following: “In addition to the obligations of the Contractor specified in § 3.4.3, the ….”

Subparagraph 10.2.5

DELETE "(other than damage or loss insured under property insurance required by the Contract Documents)"

ADD new Subparagraph 10.2.9 as follows:

10.2.9 Contractor shall immediately report in writing to Owner and Architect all accidents, other than minor accidents for which no medical treatment is required, arising out of, or in connection with the Work which cause death, personal injury or property damage, giving full details and statements of any witnesses whether or not Owner has actual knowledge of the accident. In addition, if death or serious personal injuries or serious damage are caused, the accident shall be reported immediately by telephone or messenger to Owner and Architect.

Subparagraph 10.2.8

INSERT "written" before "notice" in the first sentence.

Subparagraph 10.3.1

INSERT "written" after "Architect" at the end of the second sentence.

Subparagraph 10.3.3

DELETE entire subparagraph.

ADD a new Subparagraph 10.3.7 as follows:

[*Add:*] 10.3.7 Unless specifically approved by the Owner or required by the Contract, the Contractor shall not incorporate into the Work any materials containing asbestos or any material known by the industry to be hazardous to the health of building construction workers, maintenance workers, or occupants. If the Contractor becomes aware that a material required by the Contract contains asbestos or other hazardous materials, Contractor shall notify the Owner and the Architect immediately and shall take no further steps to acquire or install any such material without first obtaining Owner approval.

ADD a new paragraph 10.5 as follows:

[*Add:*] 10.5 COMPLIANCE WITH SAFETY LAWS. All phases of work under this Agreement shall conform to the applicable requirements of the Occupational Safety and Health Act (Public Law 91-956) as adopted by the U.S. Department of Labor and with the provisions of "Rules and Regulations Governing Construction, Demolition, and All Excavation", as adopted by the Safety Codes Commission of the Commonwealth of Virginia, 1966 (Amended 1970) and issued by the Department of Labor and Industry, P. O. Box 1814, Richmond, Virginia 23214.

ARTICLE 11 - INSURANCE AND BONDS

Paragraph 11.1 – Contractor's Insurance and Bonds

AMPLIFY Paragraph 11.1 – Contractor's Liability Insurance, by ADDING the following:

[*Add:*] During the term of the Contract, Contractor and each Subcontractor shall, as a minimum, and at their own cost and expense, maintain the following insurances in a company or companies properly licensed in the Commonwealth of Virginia.

1. The contractor will maintain a general liability policy with $2,000,000 combined single limits, with $4,000,000 in aggregate. Coverage is to be on an occurrence basis with an insurer licensed to conduct business in the Commonwealth of Virginia. The general liability insurance shall also include the broad form property damage endorsement, in addition to coverages for explosion, collapse, and underground hazards The insurer must have an A. M. Best rating of A- or better. The insurer must list the Owner and Architect as an additional insured. The endorsement must be issued by the insurance company. A notation on the certificate of insurance is not sufficient.

2. The contractor will maintain workers' compensation coverage in compliance with the laws of the Commonwealth of Virginia. The coverage must have statutory limits and be with an insurer licensed to conduct business in the Commonwealth of Virginia. The insurer must have an A. M. Best rating of A- or better. As an alternative, it is acceptable for the contractor to be insured by a group self-insurance association that is licensed by the Virginia Bureau of Insurance. The contractor will also carry employers liability insurance with a limit of at least $100,000 bodily injury by accident/$500,000 bodily injury by disease policy limit/$100,000 bodily injury by disease each employee.

3. The contractor will maintain automobile liability insurance with limits of at least $1,000,000. The coverage is to be written with a symbol "1". The insurer must be licensed to conduct business in the Commonwealth of Virginia. The insurer must have an A. M. Best rating of A- or better.

4. The contractor will maintain professional liability insurance with a limit of at least $1,000,000. It is preferred that the coverage be on an occurrence basis. If the policy is on a claims made basis, this should be noted. If the contractor has professional liability insurance on a claims made basis, agreement must be made that coverage will be maintained for at least three years beyond the expiration date of the policy in force at the time of this contract. Coverage is to be with a company licensed to conduct business in the Commonwealth of Virginia and have an A. M. Best rating of A- or better. The Owner and Architect should be listed as an additional insured on the policy. The endorsement must be issued by the insurance company. A notation on the certificate of insurance is not sufficient. (NOTE: This is only needed when professional services are being conducted by the contractor. For example if the contractor is providing professional advice or design work, the professional liability coverage should be required.)

5. The contractor will maintain a surety bond in an amount not less than the total amount payable to the contractor for the terms of this contract. The bond will be issued by a company licensed to issue surety bonds in the Commonwealth of Virginia and has an A. M, Best rating of A- or better.

With all policies listed above, the insurer or agent of the insurer must issue a certificate of insurance to show evidence of coverage. To the extent commercially and reasonably available, all wording limiting the insurer responsibility to notify the Owner and Architect of any cancellation or non-renewal of the coverage must be removed.

Subparagraph 11.1.2

ADD the following new sentence to the end of Subparagraph 11.1.2:

[*Add:*] Where Owner's and Contractor's/Subcontractor's policies each apply, Contractor's/ Subcontractor's policies shall be considered primary.

Subparagraph 11.1.3

ADD "to the extent such a provision is commercially and reasonably available" to the end of the second sentence.

Paragraph 11.3 - Property Insurance
Subparagraph 11.3.1

DELETE Subparagraph 11.3.1 in its entirety, and SUBSTITUTE the following:

[*Substitute:*] **CONTRACTOR TO PROVIDE BUILDERS RISK POLICY.** The Contractor shall purchase and maintain, from a company or companies lawfuly authorized to do business in the Commonwealth of Virginia, property insurance written on a builder's risk "all-risk" or equivalent policy "completed value" form in the amount of the total value for the entire Project at the site on a replacement cost basis. The limit will be the full replacement cost of the building and/or structures being built under this Agreement. 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 Architect, the Contractor, Subcontractors and Sub-subcontractors in the Project. School Board of the City of Staunton, VA will be listed as an insured under this policy to protect any property owned at the construction site. Coverage is to be with a company that has an A. M. Best rating of A- or better. Policies shall be written to include the names of Contractors and Owner "as their interest may appear", and all insurance shall be in effect on or before the date when construction work is to commence. The insurance to be furnished by the Contractor under this subparagraph will include a deductible of One Thousand dollars ($1,000.00) per occurrence on all perils of loss with the exception of Flood and Earthquake subject to the insurance policy forms and exclusions. The deductible shall be paid by the Contractor, or contractor(s) in proportion to their respective portions of loss, if the loss affects more than one (1) Contractor or subcontractor.

DELETE the phrase “shall be on an ‘all-risk’ or equivalent policy form and” from Sub-subparagraph 11.3.1.1. ADD the following at the end of Subparagraph 11.3.1.1:

[*Add:*] The insurance to be provided hereunder shall include coverage for materials and equipment accepted for incorporation into the completed Project and stored on the site of the Work, stored in an off-site location, or in transit. The insurance to be furnished by the Contractor under this paragraph 11.3 will cover only those materials and equipment which will become a permanent part of the completed project and scaffolding, construction forms and temporary structures if their values are chargeable to the project.

DELETE Sub-subparagraphs 11.3.1.2, 11.3.1.3, and 11.3.1.4 in their entirety, and REPLACE them with the following Sub-subparagraphs:

11.3.1.2 Following any loss which the Contractor believes may be covered by the insurance to be provided under this subparagraph 11.3.1, the Contractor shall immediately notify the insurance company and the Owner. The Contractor will report to the insurance company losses on behalf of the Owner. The Contractor shall cooperate with the Owner and the insurer, or its authorized representatives, in their efforts to investigate and settle the claim, including providing any and all requested information, documentation and reports and providing safe access to the site for inspection. Contractors’ failure to provide timely notification of loss to the Owner, or Contractors’ failure to provide requested and adequate information or documentation, shall not prejudice the Owner in any manner whatsoever.

11.3.1.3 The Contractor is responsible for notifying law enforcement or other applicable authorities in the event of a loss and for compiling all pertinent and required information in a timely manner.

11.3.1.4 Following a loss, the Contractor shall immediately take all necessary and reasonable steps to protect the property from further damage or loss.

’“”

ADD the following language to the end of Subparagraph 11.3.3:

[*Add:*] “Owner’s loss of use damages are limited to the amount paid under the Loss of Use policy. Contractor and all subcontractors shall be named as additional insureds on Owner’s Loss of Use policy, to the extent such an endorsement is available.”

DELETE Subparagraph 11.3.7 in its entirety.

Subparagraph 11.3.8

DELETE the words “as fiduciary” whenever they appear.

Subparagraph 11.3.9

DELETE the words “as fiduciary” whenever they appear.

Subparagraph 11.3.10

DELETE the words “as fiduciary”.

ADD new Subparagraphs 11.3.11 and 11.3.12 as follows:

[*Add:*] 11.3.11 The Owner reserves the right to choose and determine the manner in which any damaged work covered by the insurance provided hereunder shall be replaced or repaired and the extent to which replacement or repair shall be accomplished. In the event the Owner chooses not to replace or repair damaged Work, or chooses to have repairs or replacement accomplished by others, the Contractor(s) shall be paid in full by the Owner for the actual value of all Work accomplished on the affected portion of the damaged facility prior to the time of the loss. The Contractor(s) shall not have any claim or be entitled to any payment, including loss of profit, for the value of lost or uncompleted Work. Nor shall any provision in anyway release the Contractor or the Contractor’s surety from obligations under the Contract to fully complete the undamaged portions of the Project. In the event the Owner chooses to have the repair or replacement of the damaged work performed under this Agreement, said work shall be paid for and accomplished in accordance with the Change Order provisions of this Contract.

[*Add:*] 11.3.12 The Owner assumes no liability, and the Contractor shall have no claim against Owner, for the amount of loss claimed by the Contractor which exceeds the actual proceeds received from the Insurance provided hereunder. The Contractor shall have no claim against the Owner for any loss caused by perils not covered by the insurance provided by the Contractor hereunder, nor shall the Contractor have any claim against Owner for any loss to Contractor's materials, tools, equipment or personal property not covered by the said insurance. All costs incurred by the Contractor associated with the loss not covered by an insurance loss settlement shall be borne by the Contractor.”

Paragraph 11.4 - Performance Bond and Payment Bond
Subparagraph 11.4.1

DELETE Subparagraph 11.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph:

11.4.1

Contractor shall provide bonds in accordance with the provisions of the Contract Documents and the Commonwealth of Virginia – VPPA, and in so doing shall provide:

(a) A Performance Bond at one hundred percent (100%) of the Contact amount, conditioned upon the faithful performance of Contractor in strict accordance with the plans, specifications and conditions of the Contract. Such bond shall be solely for the protection of Owner or assignee as authorized in accordance with the provisions of Paragraph 13.2.1 herein.

(b) A Payment Bond at one hundred percent (100%) of the Contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to

Contractor or to any of their Subcontractors in the prosecution of the Work provided for in the Contract Documents and shall be conditioned for the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the Work. "Labor or Materials" shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site.

(c) Each of such bonds required by the Contract Documents shall be executed by one or more surety companies legally authorized to do business in the Commonwealth of Virginia and not otherwise objectionable to Owner. The surety of whom Contractor has purchased bonds shall have an "A-" or better rating, plus a financial rating of VI or better with the A. M. Best's Company (Key Rating Guide – Latest Edition) and listed in the Department of Treasury Circular 570, with a capacity which meets or exceeds the contract amount. The bond shall be payable to Owner or assignee as provided for in Paragraph 13.2.1

Both a Performance Bond and Payment Bond shall be required as specified under Article 7 of the Supplementary Instructions to Bidders.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK
Paragraph 12.2 - Correction of Work
Subparagraph 12.2.2 After Substantial Completion
Sub-subparagraph 12.2.2.1

DELETE the following from the first sentence and, in lieu thereof, SUBSTITUTE the following:

[*Delete:*] "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"

[*Substitute:*] "if, within one (1) year after the date of Final Completion of the Work or within one (1) year from the date of Partial Occupancy and Use and Final Completion of designated phases thereof (whichever shall first occur) or after the date for commencement of warranties"

DELETE sub-subparagraph 12.2.2.3 in its entirety and, in lieu thereof, SUBSTITUTE the following new sub-subparagraph:

12.2.2.3 In the event any Work, material or equipment is replaced or repaired as a consequence of latent defects or failure to meet the terms of the Contract Documents, all warranties with respect to such Work, material or equipment replaced or repaired shall continue following repair or replacement of such Work, material or equipment for an additional period equivalent to the original period of warranty for such Work, material or equipment.

ADD new subparagraphs 12.2.6 and 12.2.7, as follows:

[*Add:*] 12.2.6 In any case, when in fulfilling the requirements of the Contract Documents and this guarantee or any other guaranty or warranty, the Contractor disturbs any work performed by a

separate contractor, Contractor shall restore such work to a condition satisfactory to the Architect and Owner and guarantee such restored work to the same extent as if it was guaranteed under this Agreement. In the event the Work of the Contractor is to be modified by another contractor, either before or after the final inspection, the Contractor shall remain responsible in all respects under this paragraph's warranty and under any other warranties or guarantees, express or implied, applicable to or arising from this Agreement or by law. However, the Contractor shall not be responsible for any defects in material or workmanship introduced by the contractor modifying Contractor's Work. The Contractor and the contractor making the modifications shall each be solely responsible for their own respective work. The contractor modifying the earlier Work shall be responsible for any damage to or defect introduced into the Work by its modification. If Contractor claims that a subsequent contractor has introduced defects of materials and/or workmanship into Contractor's Work, Contractor shall bear the burden of making the claim to demonstrate clearly the nature and extent of such introduced defects and the other contractor's responsibility for those defects.

[*Add:*] 12.2.7 The warranties of this paragraph shall be in addition to and not in lieu of all other warranties, express or implied, applicable to or arising from this Agreement or by law.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

Paragraph 13.1 – Governing Law

DELETE the second sentence.

Subparagraph 13.3.2

REPLACE "the Owner, Architect or Contractor" with "Owner or Architect"

Paragraph 13.4 - Tests and Inspections

Subparagraph 13.4.1

DELETE Subparagraph 13.4.1 in its entirety and, in lieu thereof, SUBSTITUTE the following new subparagraph:

13.4.1 If the Contract Documents or any laws, statutes, ordinances, building codes, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction over the work or the site of the Project require any portion of the Work to be inspected, tested or approved, Contractor shall give Architect and Owner timely notice thereof so Architect and Owner may observe such inspection, test or approval.

Subparagraph 13.5 – Interest

DELETE Subparagraph 13.5 in its entirety.

ADD new Paragraph 13.6 as follows:

Paragraph 13.6 Tax Credits

13.6 The Project, or part or all of the Project or Work, may qualify for tax benefits arising from or related to the energy efficiency, energy efficiency rating, or energy efficiency score assigned to the Project or Work by the relevant taxing authority. These tax benefits include, without limitation, Internal Revenue Code §179.D and other federal, state or local tax benefits, as established by those authorities having jurisdiction over such benefits (hereinafter the "Tax Benefits"). These Tax Benefits may take various forms, including without limitation, accelerated depreciation for commercial, multifamily, and publically owned facilities. The Tax Benefits may be assignable by Owner to third parties, as provided for by the statutes, rules and regulations governing such Tax Benefits. Notwithstanding any other language contained in any of the Contract Documents, no Contractor or subcontractor shall, under any circumstances, apply for, request, receive, accept or retain any Tax Benefit arising from or related to the Project, Work, or any part of the Project or Work.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

Paragraph 14.1 - Termination by the Contractor

DELETE Paragraph 14.1 in its entirety.

Paragraph 14.2 - Termination by the Owner for Cause
Subparagraph 14.2.1

DELETE Subparagraph 14.2.1 in its entirety and, in lieu thereof, SUBSTITUTE the following:

14.2.1 Owner may terminate the Contract if Contractor:

.1 shall institute proceedings or consent to proceedings requesting relief or arrangement under the Federal Bankruptcy Code or any similar or applicable federal or state law; or if a petition under any federal or state bankruptcy or insolvency law is filed against Contractor and such petition is not dismissed within sixty (60) days from the date of said filing; or if Contractor admits in writing, its inability to pay its debts generally as they become due, or if it makes a general assignment for the benefit of its creditors, or if a receiver, liquidator, trustee or assignee is appointed on account of its bankruptcy or insolvency; or if a receiver of all or any substantial portion of Contractor's properties is appointed.

.2 abandons the Work; or if it fails, except in cases for which an extension of time is provided, to prosecute promptly and diligently the Work or to supply enough properly skilled workers or proper materials for the Work;

.3 submits an Application for Payment, sworn statement, affidavit or document of any nature whatsoever which is intentionally falsified;

.4 fails to make prompt payment to subcontractors or for materials or labor or otherwise breaches their obligations under any subcontract with a subcontractor; or if a materialman's lien or notice of lien is filed against any part of the Work or the site of the Project and not promptly bonded or insured over by Contractor in a manner satisfactory to Owner;

.5 disregards any laws, statutes, ordinances, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction of the Work or the site of the Project;

.6 otherwise violates any provision of the Contract Documents;

then Owner, upon the occurrence of the events described in clauses .1 through .6 above, without prejudice to any right or remedy available to Owner under the Contract Documents or at law or in equity may, after giving Contractor and its surety under the Performance Bond and under the Labor and Material Payment Bond, if any, seven (7) days written notice, terminate the Contract and, in accordance with the Uniform Commercial Code, may enforce a Security Agreement by taking possession of and using all or any part of Contractor's materials, equipment, supplies and other property of every kind used by Contractor in the performance of the Work in the completion of the Work. If requested by Owner, Contractor shall remove any part or all of its equipment, machinery and supplies from the site of the Project within seven (7) days from the date of such request, and in the event of Contractor's failure to do so, Owner shall have the right to remove or store such equipment, machinery and supplies at Contractor's expense. In case of such termination, Contractor shall not be entitled to receive any further payment for Work performed by the Contractor, whether before, on, or after the date of termination, except as described in paragraph 14.2.4 below. Owner's right to terminate Owner-Contractor Agreement pursuant to this Subparagraph 14.2.1 shall be in addition to and not in limitation of any rights or remedies existing hereunder or pursuant hereto or at law or in equity.

Subparagraph 14.2.4

DELETE Subparagraph 14.2.4 in its entirety and, in lieu thereof, SUBSTITUTE the following new Subparagraph 14.2.4:

14.2.4 If the unpaid balance of the Contract Sum exceeds all costs to Owner of completing the Work, then Contractor shall be paid for all Work performed by Contractor to the date of termination. If such costs to Owner of completing the Work exceed such unpaid balance, Contractor shall pay the difference to Owner upon Owner's demand. The costs to Owner of completing the Work shall include, but not be limited to, the cost of any additional architectural, legal, consulting, expert, managerial and administrative services required thereby, any costs incurred in retaining another contractor or other subcontractors, any additional interest or fees which Owner must pay by reason of a delay in completion of the Work, including attorneys' fees and expenses and any other damage, costs and expenses Owner may incur by reason of completing the Work. The amount, if any, to be paid to Contractor shall be certified by Architect upon application, in the manner provided in Paragraph 9.4, and this obligation for payment shall survive the termination of the Contract.

Paragraph 14.3 - Suspension by the Owner for Convenience

Subparagraph 14.3.1

ADD the following new sentence to the end of Subparagraph 14.3.1:

[*Add:*] Any suspension by Owner for convenience does not constitute grounds for termination by Contractor.

Subparagraph 14.4.3

DELETE the remainder of the subparagraph after the words "for Work properly executed."

ADD new Paragraph 14.5 as follows:

Paragraph 14.5 IP Indemnification

14.5 Contractor and each subcontractor shall indemnify defend and hold harmless, Owner, its officers, directors, agents, and employees, Architect and its officers, directors, agents and employees, and each of them, as "indemnitee", from and against any and all fines, penalties, losses, costs, damages, injuries, expenses, claims, liens, encumbrances and/or liabilities (individually and collectively referred to herein as "liabilities") arising out of, or resulting from any claim that any service or goods that the Contractor supplied allegedly infringed, including without limitation any patent, copyright, trademark, service mark, trade secret or other legally-protected proprietary right. Owner shall notify Contractor of any suit or legal proceeding asserting a claim for liabilities described in this paragraph. Contractor and subcontractors shall, at no cost to any indemnitee, defend and/or settle such suit or legal proceeding, or judgment, including any appellate proceeding, asserting a claim for liabilities. Contractor and subcontractors shall pay any costs and legal fees incurred by any indemnitee in connection with any liabilities, whether or not litigation is actually commenced, and shall keep indemnitiees informed as to the progress of the defense. If requested by an indemnitee, Contractor and subcontractors shall afford indemnities the opportunity to participate in the defense or settlement of any claim at their own cost or expense. With regard to any claim of infringement as referred to herein, Contractor and Subcontractors shall procure the right to continue using the services or goods, or at the indemnitiees' option, replace or modify the services or goods to make them non-infringing services or goods.

ARTICLE 15 – CLAIMS AND DISPUTES
Paragraph 15.1 - Claims
Subparagraph 15.1.1 - Definition

ADD the following new sentence to the end of Subparagraph 15.1.1:

[*Add:*] All Claims as defined in §15.1.1, and any other claim or dispute between and among Contractors, or any Contractor and Owner or Architect, shall be governed by this Article 15.

Subparagraph 15.1.2

DELETE “Substantial” and substitute “Final” before “Completion” and INSERT “or as otherwise allowed by applicable law, whichever is later” after “Work” in the first sentence.

Subparagraph 15.1.3 – Notice of Claims

INSERT “written” before “notice” in the first sentence.

Sub-subparagraph 15.1.4.2

Change “shall” to “may”.

Subparagraph 15.1.6 – Claims for Additional Time

ADD the following new Sub-subparagraphs:

15.1.6.3 In planning the construction schedule within the agreed Contract Time, it shall be assumed that Contractor has anticipated the amount of adverse weather conditions normal to the site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered.

15.1.6.4 The following Standard Baseline of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the baseline for monthly weather time evaluations. “Standard Baseline” is defined as the normal number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of adverse weather. “Adverse Weather” is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents construction activity exposed to the weather conditions or access to the site:

1. Precipitation (rain, snow, or ice) in excess of 1/10 inch liquid measure.
2. Temperatures that did not rise above that required for the day’s construction activity, if such temperature requirement is specified or accepted as standard industry practice.
3. Sustained wind in excess of 25 mph.

15.1.6.5 Contractor’s Construction Schedule must reflect the following anticipated adverse weather delays in all weather dependent activities.

Standard Baseline

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
14	7	7	8	8	7	4	5	4	4	5	7

15.1.6.6 Upon acknowledgement of the Notice to Proceed and continuing throughout the Contract, Contractor will record in a daily log the occurrence of adverse weather and resultant impact to normally scheduled Work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of Contractor's scheduled work day in order to constitute an adverse weather delay day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in a previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in sub-subparagraph 15.1.6.5 above, Architect will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a no-cost Change Order for additional days, to be executed by Owner, Architect and Contractor. If the number of actual adverse weather days do not exceed the number of baseline days on any given month, then those days carry to the subsequent months and are cumulative throughout the project. This no-cost Change Order shall be the sole remedy for delays associated with weather.

Subparagraph 15.1.7 – Waiver of Claims for Consequential Damages

DELETE Subparagraph 15.1.7, including both sub-subparagraphs, in its entirety, and in lieu thereof, SUBSTITUTE the following subparagraph:

15.1.7 Contractor waives Claims against Owner for consequential damages arising out of or relating to this Contract, including but not limited to waiving any claims for damages incurred by Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit.

Subparagraph 15.1.8 – Owner as a Contracting Body

ADD new Subparagraph 15.1.8 as follows:

15.1.8 Contractor agrees and acknowledges that Owner is a public body corporate and a political subdivision of the Commonwealth of Virginia, and the Work on the Project is public construction and not subject to the filing of Mechanics Liens, and further agrees to provide and specify in its subcontracts with subcontractors for their acknowledgment that their sole remedy as to payment for the performance of labor or the furnishing of materials exists only under the provisions of the Payment Bond.

Subparagraph 15.2.5

DELETE in the third sentence after "parties" the following: "but subject to mediation, and if the parties fail to resolve their dispute through mediation, to binding dispute resolution."

Subparagraphs 15.2.6, 15.2.7, 15.2.8

DELETE in their entirety the following: 15.2.6, 15.2.7, and 15.2.8. SUBSTITUTE a new Subparagraph 15.2.6 as follows:

[*Substitute*:] 15.2.6 Nothing in this Article 15 shall prohibit Owner from seeking equitable relief in a court of appropriate jurisdiction referenced in paragraph 15.3, without a decision of the initial decision maker, in an emergent circumstance where the initial decision maker cannot provide relief to the Owner.

Paragraph 15.3

DELETE in its entirety the provisions of paragraph 15.3 and SUBSTITUTE the following provisions:

Paragraph **15.3 Forum Selection; Waiver of Jury Trial**

15.3.1 Binding dispute resolution shall be in a court of competent jurisdiction. All actions, suits, or proceedings of any nature under the Contract or related in any way to the Project or the actions or omissions of the Contractor, Owner, or Architect as between or among any of them shall be filed and maintained solely in the Circuit Courts of the City of Staunton, Virginia, or, if federal jurisdiction exists, in the United States District Court for the Western District of Virginia, at Harrisonburg. If any action suit or proceeding is brought by the Contractor solely against the Architect, the Architect may elect to require the dispute to be the subject of mediation and, absent resolution through mediation may then elect to require the dispute to be the subject of and decided by arbitration, pursuant to the rules of the American Arbitration Association; however, neither the Architect nor the Contractor, as a condition to the Architect electing the foregoing, shall have and they each expressly waive the right to assert at any time under any circumstances any third-party claim against or to join the Owner in such proceedings.

15.3.2 Contractor, Owner, and Architect waive any and all rights to trial by jury.

15.3.3 Should any Contractor bring a claim against Owner or Architect, then, unless the fact finder finds that Contractor had a good faith basis for the claim against Owner or Architect, Contractor shall be liable to Owner and Architect for all of Owner's and Architect's costs in having all such claims dismissed, or in defending all such claims, or both. These costs shall include all of Owner's or Architect's costs, including without limitation personnel costs, attorney's fees, expert fees, consulting fees, travel expenses, compensation expenses of staff and all other attributable costs.

Paragraph 15.4

DELETE paragraph 15.4 in its entirety, and SUBSTITUTE the following:

[*Substitute*:] 15.4 REQUIRED STATE LAW PROVISION REGARDING CONTRACTOR CLAIMS AGAINST OWNER. Contractual claims against the Owner, whether for money or other relief, shall be submitted in writing no later than 60 days after final payment. However, written notice of the Contractor's intention to file a claim shall be given at the time of the occurrence or beginning of the work upon which the claim is based. Timely submission of the claim to the Initial Decision Maker shall constitute compliance with the foregoing sentence. Notwithstanding any other provision herein, the Contractor may not proceed to litigation against the Owner except in accordance with the provisions of this Article 15, and, in addition,

without submitting its claim against the Owner to the Budget Director of Owner, as the designee of the Superintendent (the "Budget Director") for consideration and evaluation pursuant to the provisions of Virginia Code § 2.2-4363(C), which are expressly incorporated herein by reference and made part hereof. Contractor may not institute legal action as provided in § 2.2-4364, prior to receipt of the Budget Director's decision on the claim, unless the Budget Director fails to render such decision within the time provided by § 2.2-4363(C). A failure of the Budget Director to render a final decision within the time provided shall be deemed a final decision denying the claim by the School Board. The decision of the Budget Director shall be final and conclusive unless the Contractor appeals within six months of the date of the final decision on the claim by the Budget Director by invoking by instituting legal action as provided in § 2.2-4364."

ADD new Paragraph 15.5 as follows:

15.5 - Scheduling and Completion

15.5.1 It is the intention of the parties through these Contract Documents that all claims between Contractors arising from or related to coordination and scheduling of the Work, and any delays, disruptions, or interferences arising from or related to the actions of Contractors, shall be resolved between or among Contractors. Specifically, by execution of the Agreement, Contractor agrees to the following:

.1 Owner and Architect and their representatives are not responsible for delays arising from or related to any act or omission of any Contractor. Owner and Architect are not responsible for any costs or damages arising from or related to a Contractor's coordination and scheduling of its Work. Owner and Architect are not liable for any costs or damages suffered or claimed by a Contractor arising from or related to any Contractor's coordination of its Work. Contractor hereby waives and releases and shall indemnify defend and hold harmless Owner and Architect from any liability and damages arising from or related to coordination by a Contractor of the Work, or coordination of the Work between or among Contractors, including their subcontractors and suppliers.

.2 Architect and Owner and their representatives shall not be liable to a Contractor for any increased costs or damages for defective work, interference, or delays arising from or related to any conflict between or among Contractors, their subcontractors and suppliers. Neither Owner nor Architect shall be joined as a party to any disputes or actions between or among Contractors or their subcontractors and suppliers concerning such additional expense or damage. Contractor's exclusive remedy in this regard shall be against any other Contractors involved in the dispute. Should any Contractor attempt to join Owner or Architect in any proceeding arising from any Claim between Contractors, including its subcontractors and suppliers, Contractor attempting to join Owner and Architect shall be liable to Owner and Architect for all of Owner's and Architect's costs arising from or related to such claims, including without

limitation, seeking to have all such claims dismissed, or in defending all such claims, or both. These costs shall include all of Owner's or Architect's costs, including without limitation personnel costs, attorney's fees, expert fees, travel expenses, and the like.

.3 It is agreed by all parties that disputes or actions between Contractors concerning any additional expense or damage herein mentioned above shall not delay completion of the Work, which shall be continued by the parties pending final resolution of a claim, including without limitation, judicial proceedings. All final construction decisions of the Lead Prime Contractor, regarding scheduling and coordination of the Work, whether rendered orally or in writing, shall be observed and followed fully.

.4 It is agreed by the parties to this Contract that the intent of this Paragraph 15.5.1 is to benefit Owner and Architect, and Owner's interests, and that the provisions of the Contract Documents shall raise Contractor and other Contractors to the status of third party beneficiaries in connection with the coordination and scheduling of the Project and related claims between or among Contractors, and for no other purpose. Each Contractor hereby waives privity of Contract defenses as to other Contractors, and any assertion that Owner or Architect is vicariously or otherwise responsible for the acts and omissions of other Contractors. Each Contractor agrees that the other Contractors have the right to file claims and litigation against Contractor in the event Contractor is alleged to have caused damage to another Contractor by reason of delay, disruption, interference, or lack of coordination, among other reasons, as more fully described in the Contract Documents.

.5 Contractor specifically releases, foregoes and waives any claims against Owner or Architect for extended overhead, delay damages, "impact" damages, loss of efficiency, loss of productivity, lost profit, or any other similar form of loss, damage or compensation, or other damages related to coordination and scheduling of the Project and all delays, disruptions, and interferences caused by the other Contractors.

15.5.2 Claims Related to Project Delay, Acceleration, Hindrances, Loss or Productivity or Similar Damages

As stated above in Subparagraphs § 3.3.4, § 6.1.3 and § 8.3.3, Contractor shall not pursue any claim for money damages against Owner, Architect, Owner's Representative (or their respective directors, employees or agents) in the event of any project delay, acceleration, hindrances, loss of productivity or similar damages, but shall be entitled to pursue a claim or dispute resolution proceeding for money damages against any other responsible Contractor pursuant to this Article 15. Each Contractor acknowledges it may be subject to third-part beneficiary claims and litigation brought by other Contractors for money damages as stated above, and expressly waives any privity of contract defense with regard to such proceedings. Each Contractor further agrees it will not bring Owner, Architect, Owner's Representative (or their respective directors, employees or agents) into any such claim or litigation proceedings as a party thereto, and will be subject to the indemnification provisions of Subparagraph § 8.3.3 if it violates this commitment.

END OF SECTION 000750

SECTION 000920 PREVAILING MINIMUM WAGE (DAVIS-BACON ACT)

The Project to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

(1) Minimum wages. (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
(*2*) The classification is utilized in the area by the construction industry; and
(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) *Withholding.* Staunton City Public Schools shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) *Payrolls and basic records*. (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program

described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Staunton City Public Schools if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the Staunton City Public Schools. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at *http://www.dol.gov/esa/whd/forms/wh347instr.htm* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Staunton City Public Schools if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the Staunton City Public Schools, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(*1*) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(*2*) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by

paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Staunton City Public Schools or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees*—(i) *Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees*. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training

Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) ***Equal employment opportunity.*** The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts***. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the Staunton City Public Schools may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) ***Contract termination: debarment***. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.*** (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a

Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) *Contract Work Hours and Safety Standards Act.* The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by § 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours

(2) in such workweek.

(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. Staunton City Public Schools shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

"General Decision Number: VA20240001 01/05/2024

Superseded General Decision Number: VA20230001

State: Virginia

Construction Type: Heavy Dredging

Counties: Virginia Statewide.

DREDGING CONSTRUCTION PROJECTS (Excluding HOPPER DREDGING)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024

ENGI0025-004 10/01/2022

STATEWIDE

	Rates	Fringes
Dredging: (Includes Clamshell Dredges, Hyrdraulic Dredges 20"" and over: Tug Boats)		
CLASS A1	$ 43.94	14.49+a+b
CLASS A2	$ 39.16	14.20+a+b
CLASS B1	$ 38.00	14.13+a+b
CLASS B2	$ 35.77	14.00+a+b
CLASS C1	$ 34.79	13.69+a+b
CLASS C2	$ 33.67	13.62+a+b
CLASS D	$ 27.97	13.28+a+b

CLASSIFICATIONS:
CLASS A1: Deck Captain; Mechanical Dredge Operator, Leverman, Licensed Tug Operator over 1000 HP.
CLASS A2: Crane Operator (360 swing).
CLASS B1: Derrick Operator (180 swing), Spider/Spill Barge Operator, Engineer, Electrician, Chief Welder, Chief Mate, Fill Placer, Operator II, Maintenance Engineer, Licensed Boat Operator, Licensed Crew Boat Operator.
CLASS B2: Certified Welder.
CLASS C1: Mate, Drag Barge Operator, Assistant Fill Placer, Welder, Steward.
CLASS C2: Boat Operator.
CLASS D: Oiler, Deckhand, Shoreman, Rodman, Scowman, Cook, Messman, Porter/Janitor.

INCENTIVE PAY: (Add to Hourly Rate)
Operator (NCCCO License/Certification) $1.80 Licensed Tug Operator over 1000 HP (Assigned as Master) (USCG licensed Master of Towing Vessels (MOTV) $1.80; Licensed Boat Operator (Assigned as lead boat captain) USCG licensed boat operator $1.30; Engineer (QMED and Tankerman endorsement or licensed engineer (USCG) $1.80
Oiler (QMED and Tankerman endorsement (USCG) $1.80; All classifications (Tankerman endorsement only) USCG $1.55; Deckhand or Mate (AB with Lifeboatman endorsement (USCG) $1.80; All classifications (lifeboatman endorsement only (USCG) $1.55; Welder (ABS certification) $1.55

FOOTNOTES APPLICABLE TO ABOVE CRAFTS:
a. PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr.'s Birthday, Memorial Day, Good Friday, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day
b. VACATION: Eight percent (8%) of the straight time rate, multiplied by the total hours worked.

SUVA1994-008 11/01/1994

	Rates	Fringes
Dipper Dredges		
Deckhand	$ 9.50 **	2.96+a
Engineer	$ 14.04 **	2.96+a
Handyman	$ 9.50 **	2.96+a
Launchman	$ 10.12 **	2.96+a
Mate	$ 12.39 **	2.96+a
Oiler	$ 10.12 **	2.96+a
Operator	$ 14.59 **	2.96+a
Rodman	$ 9.50 **	2.96+a

Scowman	$ 9.63 **	2.96+a
Welder	$ 12.78 **	2.96+a
Drill Boats		
Blaster	$ 13.69 **	2.96+a
Driller	$ 13.69 **	2.96+a
Engineer	$ 14.18 **	2.96+a
Hydraulic Dredges Under 20""		
Carpenter	$ 13.14 **	2.96+a
Deckhand	$ 9.50 **	2.96+a
Derrick Operator	$ 13.20 **	2.96+a
Electrician	$ 13.45 **	2.96+a
Engineer	$ 14.18 **	2.96+a
Handyman	$ 9.50 **	2.96+a
Janitor/Porter	$ 9.50 **	2.96+a
Leverman	$ 14.53 **	2.96+a
Mate	$ 12.39 **	2.96+a
Messman	$ 9.32 **	2.96+a
Night Cook	$ 9.50 **	2.96+a
Oiler	$ 10.12 **	2.96+a
Rodman	$ 9.50 **	2.96+a
Second Cook	$ 9.50 **	2.96+a
Shoreman	$ 9.32 **	2.96+a
Spider Barge Operator	$ 12.97 **	2.96+a
Spill Barge Operator	$ 12.97 **	2.96+a
Steward	$ 10.42 **	2.96+a
Tug Deckhand	$ 9.50 **	2.96+a
Tug Master	$ 12.29 **	2.96+a
Tug Mate	$ 11.76 **	2.96+a
Welder	$ 12.78 **	2.96+a
Steward Department (On Dipper Dredges)		
Cook	$ 9.27 **	2.96+a
Mess Cook	$ 8.74 **	2.96+a
Messman and Janitor	$ 8.61 **	2.96+a
Tug Boats (Tending Dipper Dredges)		
Assistant Engineer	$ 11.75 **	2.96+a
Cook	$ 9.63 **	2.96+a
Deckhand	$ 9.37 **	2.96+a
Engineer	$ 12.96 **	2.96+a
Tug Master	$ 13.16 **	2.96+a
Tug Mate	$ 11.87 **	2.96+a

FOOTNOTES APPLICABLE TO ALL ABOVE CRAFTS:

a. PAID HOLIDAYS AND VACATION:
New Year's Day, Memorial Day, Independence Day, Good Friday, Labor Day, Thanksgiving Day, and Christmas Day; plus vacation contribution of 7% of straight time pay for all hours worked.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage

determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION"

GEOTECHNICAL DATA

A. Geotechnical Data concerning subsurface materials or conditions which are based upon test pits or test borings has been obtained by the Owner for the Architect's use in designing the Project. Its accuracy or completeness is not guaranteed by Owner or Architect and in no event is it to be considered part of the contract drawings or specifications.

B. Contractor shall assume all responsibility in earthwork for this Project and shall not rely on subsurface information obtained from Architect or Owner. Bidders shall make their own investigation of existing subsurface conditions; neither Owner, nor Architect will be responsible in any way for additional compensation for excavation work performed under the Contract due to Contractor's assumptions based on Geotechnical Data prepared solely for the Architect's use.

GEOTECHNICAL ENGINEERING REPORT

PROJECT NAME

SHELBURNE MIDDLE SCHOOL ADDITIONS

Staunton, VA

PROJECT NO.
20220692



PREPARED FOR
Crabtree, Rohrbaugh & Associates
250 West Main Street
Suite 200
Charlottesville, VA 22902

DATE
October 6, 2023

COMMONWEALTH OF VIRGINIA
GLENN E. COOKE
Lic. No. 060997
10/06/2023
PROFESSIONAL ENGINEER

HURT & PROFFITT
434.847.7796
WWW.HANDP.COM

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Appendix G ..... Expansion Index Results

HURT & PROFFITT

October 6, 2023

Mr. Joshua C. Bower, AIA
Principal
Crabtree, Rohrbaugh & Associates
250 West Main Street
Suite 200
Charlottesville, VA 22902

Sent via email to: jbower@cra-architects.com

Re: Geotechnical Engineering Report
Staunton City Schools
Shelburne Middle School Additions
300 Grubert Ave, Staunton, VA 24401
H&P Project #: 20220692

Dear Josh:

Hurt & Proffitt, Inc. (H&P) has completed the subsurface investigation for the proposed additions and site improvements at Shelburne Middle School in Staunton, Virginia. This report presents our understanding of the project requirements, the results of the work performed, and associated recommendations.

The geotechnical engineering investigation included the following scope of services:

- Initiate VA811 utility locate request
- Perform seven (7) standard penetration test (SPT) borings plus one (1) hand auger boring
- Laboratory soils testing (soil classification, standard proctor, expansion index, CBR, and natural moistures)
- Measurements for potential groundwater and borehole cave-in depths
- Geotechnical investigative report preparation

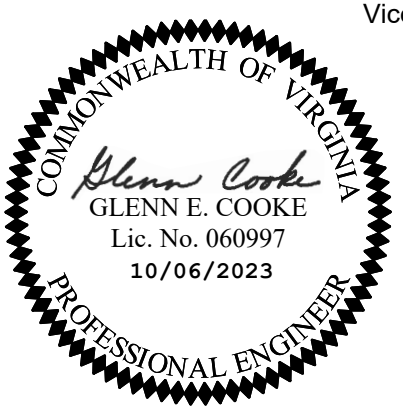
H&P appreciates the opportunity to complete this study for you. Should you have any questions about the findings and results of this investigation, please do not hesitate to contact us.

Sincerely,
Hurt & Proffitt, Inc.

Glenn E. Cooke, P.E.
Project Manager

J. Kenneth Meritt, P.G., P.E.
Vice President—Director of Geotechnical and Materials Testing

attachments:



Shelburne Middle School Additions
Staunton, Virginia

1.0 PROJECT INFORMATION

Staunton City Schools (Owner) is planning to upgrade Shelburne Middle School. Improvements include a new addition to serve as the performing arts building, an outdoor amphitheater, and an outdoor classroom area. As part of the new upgrades, civil related improvements are also planned. Current plans show the new performing arts building to be constructed on the north side of the existing middle school building and the proposed amphitheater to the west. Figure 1 below is an excerpt from a topographic survey prepared by H&P. Boring locations associated with the geotechnical investigation are also depicted.

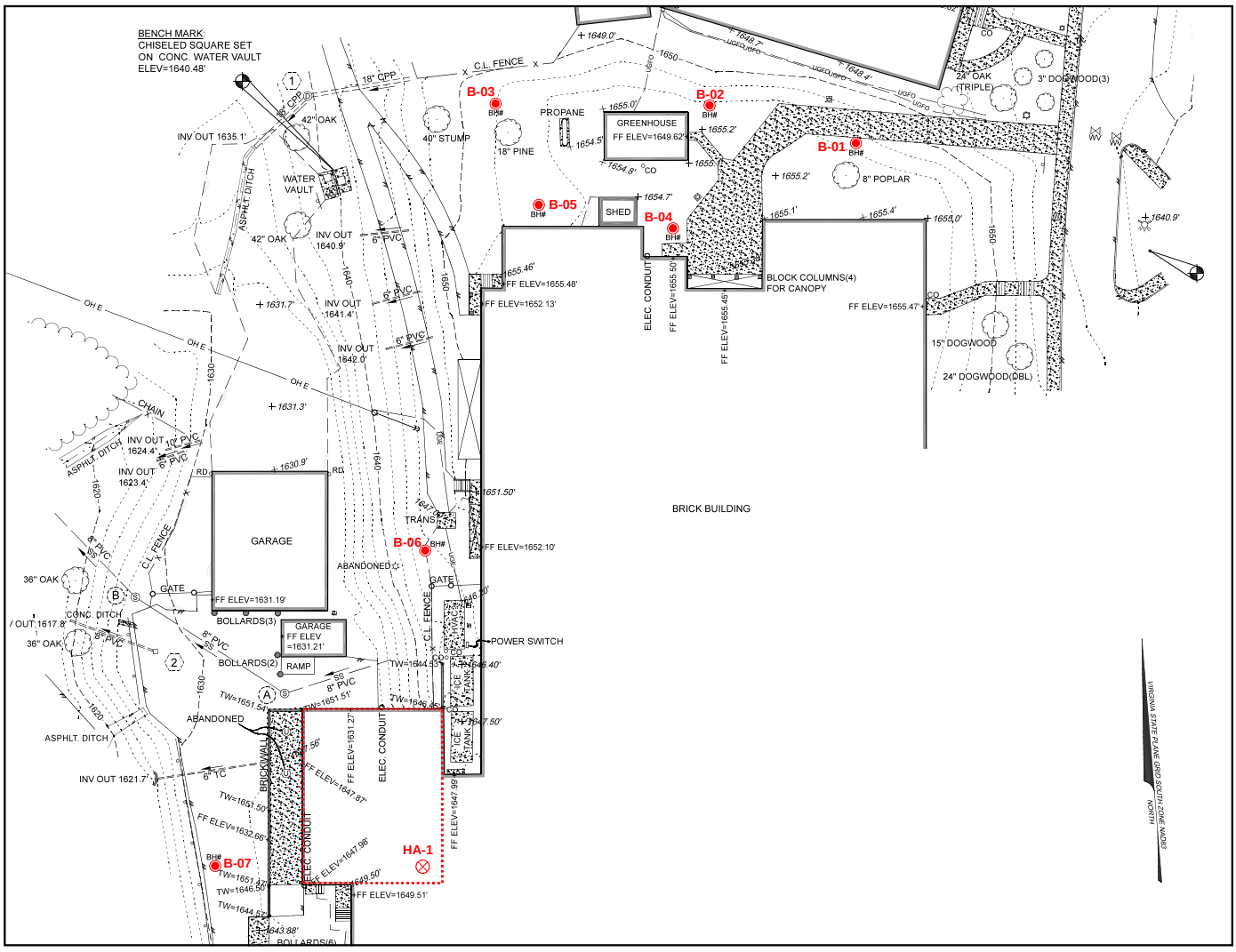


Figure 1: Excerpt from Preliminary Grading Plan

2.0 SUMMARY OF FINDINGS

As part of this investigation, H&P reviewed USGS and geological maps, historical aerial imagery, and a preliminary grading plan by H&P. A review of Virginia Energy's website was also completed considering the site is located in a karst prone geology. Subsurface exploration and site characterization were done by performing seven (7) borings with standard penetration tests and one (1) hand auger boring with DCP testing to evaluate the apparent consistency and/or relative density of the underlying subsurface profile in areas planned for construction. Laboratory soil testing was conducted to classify representative soil samples, determine maximum dry density at optimum moisture conditions (Proctor), determine shrink/swell potential by means of expansion index testing, and determine a CBR value.

Boring results revealed a subsurface profile mostly comprised of residual soil conditions with a layered sequence common to the area. Existing fill soils were also found but were limited to the upper 4 to 5 feet of B-06 and B-07. Cohesive clay bearing soils with high plasticity were found in the upper profile followed by coarse-grained clayey sand type soils. In general, soil stiffness in the upper profile was mostly stiff. Soft soil conditions were encountered at B-05 and B-06 but were found at deeper depths. Hard rock was identified via hollow-stem auger refusal at B-01, B-02, and B-06 at 26, 22.3, and 27.7 feet below existing grades, respectively. Based on our review of the preliminary grading plans, minimal earthwork and grading will be necessary to reach final soil subgrade elevations. To establish final grade, a retaining wall is shown along the north side of the building addition. With clay bearing soils prevalent across the site, H&P expects select import material will be needed to provide quality granular backfill for the retaining wall. Recommendations for subgrade preparation and new fill placement can be found in the Earthwork & Grading Section.

Settlement calculations were performed using maximum building loads provided by the architect. Based on estimated settlements of 1-inch, an allowable soil bearing capacity of 2,000 pounds per square foot (psf) may be used for design of shallow spread and strip footing foundations. For additional information, refer to Section 7.2 of this report.

3.0 INVESTIGATIVE PROCEDURES

The field investigation consisted of seven (7) standard penetration test (SPT) borings plus one (1) hand auger boring with dynamic cone penetrometer (DCP) testing. Borings were assigned a target termination depth of 30 feet; however, as mentioned above, refusal occurred at 3 out of 7 locations prior to reaching the target depth. Additionally, B-05 was extended to 40 feet after soft conditions were noted at 30 feet below existing grade. The existing ground surface elevation at each borehole location was estimated using 2-foot contour intervals determined from H&P's topographic survey. Measurements for potential groundwater conditions and/or cave-in depths were recorded at the completion of each test boring and prior to backfilling the boreholes either the following day or at the end of the day. After final readings were recorded, all boreholes were backfilled with soil cuttings.

The hand auger boring (HA-1) was performed inside an existing building. Concrete coring was done at HA-1 to gain access to the soils below. DCP testing was performed at approximate 1-foot intervals until hand auger refusal occurred at 7.8 feet below existing grade. DCP testing is conducted with a 15 pound steel mass falling 20 inches and striking an anvil to initiate penetration of a 1.5-inch diameter cone that has been seated into the soil subgrade at the desired elevation. The blows required to drive the embedded cone three consecutive 1.75-inch increments have been empirically correlated to N-values derived from the Standard Penetration Test (SPT). DCP results are shown on the last page of the Test Boring Logs in Appendix B.

The test borings were performed in accordance with generally accepted practices using a low-ground pressure rubber track-mounted CME 55 drill rig. Continuous flight hollow-stem augers were advanced to pre-selected depths, the center plug removed, and a disturbed soil sample recovered with a standard split-spoon sampler (1.375-inch I.D., 2.0-inch O.D.) in accordance with ASTM D 1586. Sampling is conducted by driving the split-spoon sampler into the soil profile using a weight of 140 pounds that is freely dropped from a height of 30 inches. Standard sampling was initiated beginning at ground surface and continued to 10 feet and then every 5 feet thereafter. As the borehole is advanced, the quantity of applied blows required to drive the sampler in three consecutive 6-inch increments is recorded. The quantity summed of the second and third increments equates to the Standard Penetration Resistance N-value in units of blows per foot (bpf). The N-value is a measure of in-situ soil conditions and has been correlated with the engineering properties of soils for design purposes.

While the SPT test does not provide a direct evaluation of soil parameters, generalized correlations have been empirically developed for soil modulus, friction angle, and cohesion that are used to evaluate foundations, slopes, and other soil-supported structures. For design purposes, the N-value is often corrected to account for energy level (N_{60}) and existing overburden pressure ($N_{1,60}$). Other factors, such as rod length and the borehole diameter, are also considered. A correction factor of 1.3 was assumed based on the use of an automatic hammer and a split-spoon sampler deemed to be in fair condition. References to N-values within this report have not been corrected.

Soil samples were assessed in the field with representative specimens placed in glass jars and then transported to our Lynchburg laboratory where a Professional Geologist reviewed and visually classified the specimens using the Unified Soil Classification System (USCS). The jar samples are being stored at our Lynchburg laboratory where they will remain for 90 days unless a written request to retain the samples is received. Bulk soil samples were also collected and transported to our Lynchburg laboratory for soil testing. Applicable ASTM test standards are listed below, and results are summarized in Table 2 on page 6. Detailed results are appended.

- Atterberg Limits — ASTM D 4318
- Sieve Analysis — ASTM D 6913
- Natural Moisture — ASTM D 2216
- Expansion Index — ASTM D 4829
- Standard Proctor — ASTM D 698
- CBR Analysis — VTM-8, modified

Additional natural moisture analyses (ASTM D 2216) were performed on select split-spoon samples. The results from each analysis can be found on the Test Boring Logs in Appendix B.

4.0 REGIONAL GEOLOGY

Geologically, the project site is located in the highly folded and faulted Valley and Ridge province. According to the Geology of Staunton, Churchville, Greenville, and Stuarts Draft quadrangles, Virginia, the underlying bedrock is mapped as middle Cambrian-aged sedimentary rocks belonging to the Beekmantown Formation. An excerpt from the referenced map is shown below (Figure 2) with approximate site location annotated. The primary lithologies for the Beekmantown Formation are fine-grained limestone and dolomite which are also known for being suspectable to the formation of karst features (sinkholes). An expanded explanation regarding karst is provided on the next page as well as aerial image showing a documented sinkhole southeast of the school.

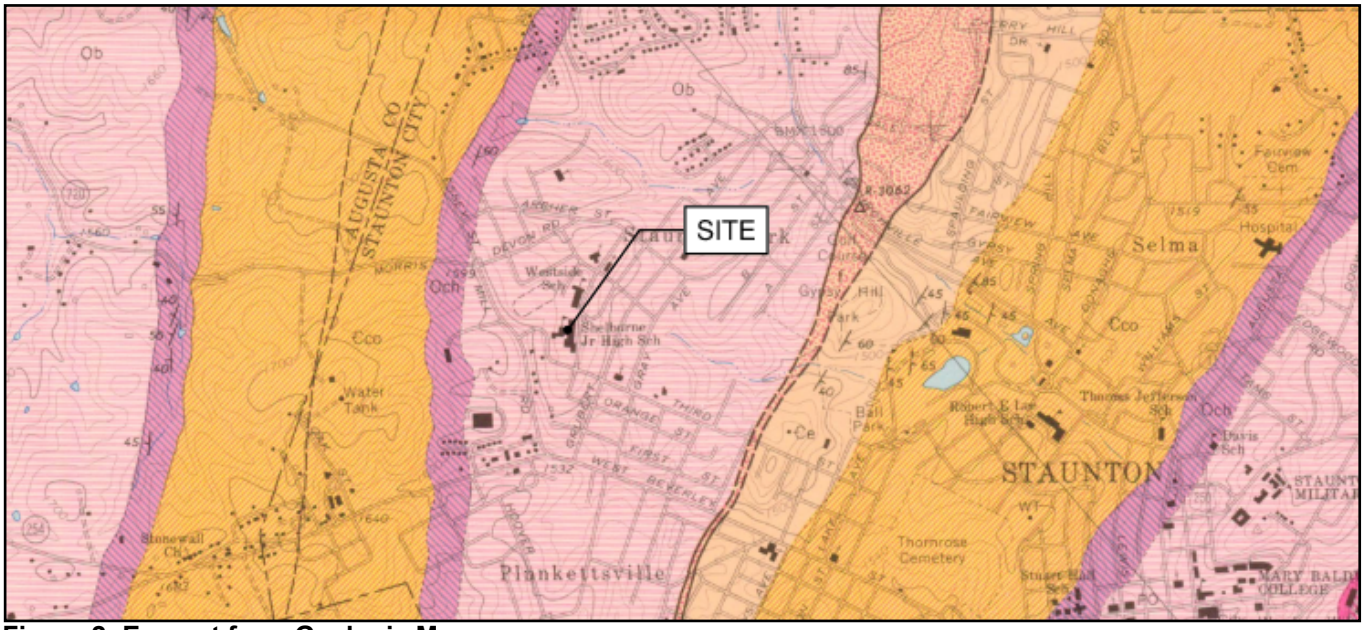


Figure 2: Excerpt from Geologic Map

As stated on the previous page, the project is situated in an area known for having karst topography. Areas having the greatest concentration of karst features or sinkholes are controlled by bedrock stratigraphy and structure as well as proximity to major drainages. Sinkholes typically form when carbonate materials solution in water over long periods of time, causing voids in the rock. The solution process typically occurs along planes of more soluble material and causes the formation of interconnected seams and cavities within the carbonate formations. This process is also affected by groundwater flow rate and chemistry. Seams and cavities are frequently filled with soft material that has not dissolved or soil that infiltrates into the seams or cavities from above. Sinkholes, or karst features, can result from the collapse of material bridging over the top of caverns formed during the solution process. In some areas, individual sinkholes form in clusters and are separated by narrow ridges of bedrock. Upper Cambrian and Middle Ordovician limestone are more soluble than Cambrian and Lower Ordovician dolomite and shaly dolomite; therefore, areas of limestone have the greatest number of sinkholes and caves. However, Cambrian and Ordovician dolomite and limestone show enhanced karst development in areas of low bedrock dip; where bedding is intensely folded, cleaved, and jointed; or near major drainages. Although the boring results suggest a low risk of karst in the project footprint, a documented mapped feature is shown on Virginia Energy's website (https://energy.virginia.gov/webmaps/GeologyMineralResources/) approximately 950 feet southeast of the site (See Figure 3 below).



Figure 3: Mapped Karst Features

5.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered during the exploration are summarized in the following paragraphs with specific descriptions found on the Test Boring Logs in Appendix B. Transitions between soil strata, as shown on the logs, are a function of the sample interval, actual changes are typically less distinct and can be difficult to discern. Although the logs are representative of the subsurface conditions at the borehole locations shown, they are not necessarily indicative of subsurface conditions at other locations.

5.1 Existing Subgrade/Surficial Conditions

Topsoil was noted at borehole locations B-01 through B-05 with an estimated thickness ranging from 4 to 12 inches. At B-06, 6 inches of crushed stone was present and at B-07, 4 inches of asphalt underlain by 8 inches of base course stone was found. Lastly, 6 inches of concrete was noted at the hand auger borehole location performed inside an existing building (see Appendix A for locations).

5.2 Existing Fill Soils

Existing fill soils were found in the upper 4 to 5 feet of boreholes B-06 and B-07, respectively. The fill soils were identified as coarse-grained Clayey SAND (SC) type soils. When subject to SPT testing to determine relative density, the fill soils produced N-values ranging from 4 to 8 bpf, thus corresponding to very-loose to loose relative density. The recorded N-values are an indication that marginal compactive effort was applied during placement. Undercutting and/or subgrade stabilization may be necessary in these areas.

5.3 Residual Soil Conditions

Residual soils that have weathered in place due to the decomposition of the parent sedimentary rock underlying the site were found at all locations. The typical layered sequence consisted of cohesive FAT CLAY (CH) and Lean CLAY (CL) soils underlain by coarse-grained Clayey SAND (SC) and Silty SAND (SM) type soils. Gravelly type soils with increased rock fragments were also encountered but were limited in layer thickness. The consistency of the cohesive residual soils ranged from very-soft to very-stiff with N-values ranging from Weight of Hammer over 18 inches (WoH/18”) to 26 bpf. Softer soil conditions were limited and mostly found at B-05 and B-06 at deeper depths. The relative density of the coarse-grained SM ranged from loose to very-dense with N-values ranging from 9 to 58 bpf. The presence of rock fragments in the gravelly layers produced elevated blow counts due to plugging of the split-spoon sampler; therefore, the recorded N-values for these layers were deemed not indicative of corelated strength parameters.

5.4 Weathered Rock Conditions

Weathered rock or partially weathered rock (PWR) are descriptions generally used when SPT N-values exceed 50 blows for a given 6-inch increment. Other evidence, such as increased applied down pressure to advance the augers or casing and slow drilling can also be used to estimate the depth and layer thickness of weathered rock. Typically, the rock structure is preserved, and the material will crush to a sandy silt or silty sand type soil. Based on the previously described criteria, partially weathered rock conditions were encountered at B-01 at 14 feet below existing grade but transitioned back to soil and then to PWR again just above the refusal depth.

5.5 Auger Refusal/Hard Rock Conditions

Auger refusal, which is typically an indication that the top of the bedrock surface has been reached, occurred at 3 out of 7 borehole locations (B-01, B-02, & B-06) at depths ranging from 22.3 to 27.7 feet below existing grades. Although the results are favorable when comparing proposed grades to refusal elevations, considering the local geology, it would not be uncommon to encounter isolated anomalies or rock pinnacles in unexplored areas of the site.

5.6 Subsurface Water Conditions

Measurements for borehole cave-in depths and potential groundwater conditions were collected after each boring was done and/or the following day when applicable. Field personnel also looked for other signs of potential groundwater conditions, such as very-moist/wet SPT soil samples and free moisture on the split-spoon sampler or rods. Based on the findings, groundwater was not encountered above borehole cave-in depths. Although the findings are favorable in terms of avoiding groundwater during construction, contractors should still be prepared to implement dewatering measures if necessary.

Table 1: Test Boring Elevation Datum

TEST BORING LOCATION	GROUND SURFACE ELEVATION	AUGER REFUSAL DEPTH (ft)	TOTAL BORING DEPTH (ft)	AUGER REFUSAL ELEVATION	BOTTOM OF BORING ELEVATION	ESTIMATED GROUNDWATER DEPTH (ft)	ESTIMATED GROUNDWATER ELEVATION	BORING CAVE-IN DEPTH (ft)
B-01	1654.0	26.0	26.0	1628.0	1628.0	—	—	23.0
B-02	1655.0	22.3	22.3	1632.7	1632.7	—	—	14.0
B-03	1652.0	—	30.5	—	1621.5	—	—	17.8
B-04	1655.0	—	30.5	—	1624.5	—	—	19.4
B-05	1654.0	—	40.5	—	1613.5	—	—	22.0
B-06	1645.0	27.7	27.7	1617.3	1617.3	—	—	22.0
B-07	1631.0	—	30.5	—	1600.5	—	—	21.4

6.0 LABORATORY RESULTS

The following table summarizes the results of each laboratory soils analysis performed along with the location, depth range, and corresponding method for which each specimen was collected. Formal laboratory results are appended.

Table 2: Summary of Laboratory Results

TEST BORING LOCATION	DEPTH RANGE (ft)	SAMPLE METHOD	USCS SYMBOL	ATTERBERG LIMITS			-#200 SIEVE (%)	NATURAL MOISTURE CONTENT (%)	STANDARD PROCTOR		CBR AT 0.1"	EXPANSION INDEX
				LL	PL	PI			OPTIMUM MOISTURE (%)	MAX DRY DENSITY (pcf)		
B-05	2-6	Bulk	CL	47	23	24	61.7	19.0	—	—	—	19,Low
B-06	2-6	Bulk	CH	54	27	27	84.5	27.4	20.3	102.2	4.3	35, Low

Laboratory ASTM Test Standards:

- Atterberg Limits ASTM D 4318
- Sieve Analysis ASTM D 6913
- Natural Moisture ASTM D 2216
- Expansion Index ASTM D 4829
- Standard Proctor ASTM D 698
- CBR Analysis VTM-8, modified

7.0 DESIGN & CONSTRUCTION RECOMMENDATIONS

The objective of this section is to provide recommendations as they relate to the design and construction of the new building addition, amphitheater, as well as any supporting civil-related improvements. The recommendations are based on the results of this investigation and review of a preliminary grading plan prepared by H&P.

7.1 Earthwork & Grading

The earthwork and grading section of this report is intended to address subgrade preparation work and new fill placement.

- A comprehensive study should be performed to determine the identity and location of any utilities within the limits of disturbance (LoD). Removal/relocation of existing utility infrastructure seems probable.

- To accommodate the new improvements, demolition of existing structures will be necessary. This includes but is not limited to existing hardscape features, a greenhouse building, and a shed.

- All organic bearing topsoil should be removed from areas planned for construction. Topsoil may be used to cap off “green space” but is not acceptable for structural fill applications. Removal of existing landscaping features will also be required.

- Properly prepared subgrades should be verified via proof-roll observation by a qualified geotechnical representative. This is an important step to verify firm subgrade conditions are present before new fill placement and/or following cut excavations. Proof-rolling should be done with a fully loaded tandem dump truck when applicable. During the proof-rolling process, it is recommended that a roller pattern be established that will maximize the densification of the subgrade before fill placement. Proof-rolling should be performed during favorable weather conditions and not while the site is wet because of recent precipitation. Areas that pump, rut, weave, or otherwise deemed unsuitable or unstable by the geotechnical representative, should be excavated and replaced as directed by the geotechnical representative.

- Moisture conditioning during grading seems probable, especially considering the natural moisture content of the bulk sample subject to Proctor testing was over 7% higher than the optimum moisture content. Moisture conditioning of soils, in particular the on-site cohesive Fat and Lean Clay type soils, can be time consuming, thus resulting in construction delays. Common methods for drying include scarification, disking, and aeration. Drying times can vary significantly depending on air temperatures, season, exposure to precipitation, and the amount of available space to spread the material thin enough to allow for sufficient drying. Proper staging and handling can help minimize the impacts of inclement weather. For example, stockpiles should be tracked-in with side slopes that promote drainage.

- Compacted structural fill may be constructed using on-site soils that are clean and free of debris and other deleterious materials. If off-site soils are needed from a borrow source, suitable soils include cohesive and non-cohesive soils with low to medium plasticity as defined by USCS. For the local area, these soils generally include CL, ML, SC, and SM.

- Other site grading considerations include the construction of retaining wall structures. Current plans show a wall north of the new building addition. At the time this report was prepared, a particular wall type had not been selected. One option is a mechanically stabilized earth (MSE) wall system comprised of a segmental block facing and geogrid reinforced backfill. Other options include a heavy block gravity wall system, or for shorter wall sections, a cast-in-place reinforced concrete retaining wall. Regardless of the wall type that is selected, backfill material should be granular in composition with low plasticity, unlike much of the cohesive soils encountered on-site. Recommended lateral earth pressures for a cast-in-place concrete retaining wall are listed below. Backfill specifications for an MSE wall system should be provided by the licensed professional engineer that designs the wall.

7.1.1 Structural Fill Placement

Proper placement of structural fill material is essential to the structure that the soil mass is intended to support. Compaction improves the engineering properties of the soil mass by increasing shear strength and reducing compressibility. The following are recommendations for properly placing compacted soil fill.

Structural fill material under and within 15 feet of building pads should be placed uniformly in horizontal lifts, with a maximum 8-inch loose thickness, and compacted to at least 98% of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor).

Structural fill material for retaining walls, utilities, sidewalks, and other civil-related improvements should be placed uniformly in horizontal lifts, with a maximum 8-inch loose thickness, and compacted to at least 95% of the material's maximum dry density as determined by ASTM D 698 (Standard Proctor).

Table 3: Recommended Minimum Density Test Frequencies

Location of Fill Placement	Minimum Test Frequency
Building Pads	One (1) compaction test per 1,000 square feet per lift
Segmental Block Wall Backfill	One (1) compaction test per 500 square feet per lift
Sidewalks & Exterior Grade Slabs	One (1) compaction test per 2,500 square feet per lift
Utilities	One (1) compaction test per 50 lineal feet per lift

Note: A minimum of three (3) compaction tests are recommended per lift, regardless of area or length.

The soils on-site are moisture sensitive and will become difficult to work with in wet weather. Attempts to work wet soils can result in deterioration of otherwise suitable soil conditions or deterioration of previously placed and properly compacted fill. The avoidance of such deterioration and subsequent over-excavation and replacement should be the responsibility of the contractor. Excessively wet or excessively dry soils should not be used as fill materials unless the soils are properly dried or wetted to an acceptable moisture content. The use of on-site soils is contingent on the contractors' ability to moisture condition the soil to within a few percent of optimum moisture content, as well as apply the necessary compactive effort adequate to achieve minimum compaction requirements. A moisture content range of plus 2 or minus 3 percentage points from the optimum moisture content of the material being placed is recommended to achieve target densities.

Site grading should promote positive drainage away from proposed structures and not allow ponding of water on building pads or other prepared soil subgrades. A 2% slope is recommended. On-site fill zones should be sealed using a smooth drum roller to promote drainage and minimize infiltration before exposure to precipitation. For areas requiring additional fill placement, sealed subgrades should be scarified to help bond the subsequent fill layer.

7.2 Foundations & Slabs-on-Grade

Recommendations for foundation support for the new proposed performing arts building addition were formed based on intended use, finished floor elevation (FFE) of 1655.5 feet, provided loads, estimated settlements, and subsurface exploration findings. Maximum estimated building loads were provided by Crabtree, Rohrbaugh & Associates and are shown below. The loads were used to evaluate settlement and determine an allowable soil bearing capacity.

Maximum Estimated Building Loads:
Strip (Wall) Footings: 3.3 klf
Spread (Column) Footings: 100 kips

7.2.1 Shallow Foundations

Estimated settlements were computed by modeling an ideal subsurface profile using SPT boring results with maximum loads supported on a conventional shallow spread and strip footing foundation system. Based on estimated settlements of 1-inch, a net allowable soil bearing capacity of 2,000 psf may be used for design.

The purpose of the hand auger boring was to evaluate the soil conditions under a proposed new elevator. Based on the DCP test results, the foundation for the elevator may also be designed using a net allowable soil bearing capacity of 2,000 psf.

Geotechnically, minimum footing depths are typically controlled by frost depth, shrink/swell potential, bearing capacity (settlement), or a combination thereof. Because the soils have a low shrink/swell potential, corrective action with respect to expansive soil conditions is not necessary. The recommended minimum footing depth for exterior strip and spread footing foundations is 24 inches to satisfy the minimum depth for frost protection.

Excavations for footings should be made in such a way as to provide bearing-surfaces that are firm and free of loose, wet, or otherwise disturbed soils. All foundation elements bearing directly on underlying subgrades should be consolidated using manually-operated vibratory equipment to promote densification of material disturbed by excavation as well as underlying loose subgrade soils. Concrete for footings should be placed the same day as the bearing surface is prepared to prevent softening due to overnight rain or other precipitation. H&P recommends footings be tested using a dynamic cone penetrometer (DCP) by qualified geotechnical personnel to verify suitable bearing conditions. Unstable bearing subgrades should be over-excavated to the depth and lateral limits recommended by the on-site geotechnical personnel. Compacted #21A VDOT size aggregate or flowable fill are options that may be used to replace undercut materials.

7.2.2 Interior Grade Slabs

Interior floor slabs may be designed as slab-on-grade with a minimum 4-inch layer of crushed stone aggregate beneath all interior grade slabs. Although #57 size aggregate may be used, compacted #21A/B size aggregate will provide better support for grade slabs and minimize deterioration of the subgrade soils resulting from trapped stormwater runoff that often accumulates during construction. Based on the on-site soil conditions and CBR results, a subgrade modulus (k) of 125 pounds per cubic inch (pci) may be used for the design of subgrades prepared per the recommendations described in this report. The American Concrete Institute (ACI) considers a proof-roll the most effective subgrade evaluation method for verifying suitable subgrade conditions for grade slab support.

7.2.3 Site Class Seismic Rating

A site class seismic rating was determined using the average standard penetration resistance procedure. Although this approach requires a boring reach a depth of 100 feet below existing grade, based on our experience with the local geology, it is reasonable to assume that auger refusal occurred on bedrock and that the bedrock profile continues throughout the remaining 100-foot length. Based on this assumption and a weighted analysis SPT N-values, a site class seismic rating of “D” was determined. The mapped Spectral Response Acceleration at short periods is S_S = 0.16. The mapped Spectral Response Acceleration at one-second periods is S_1 = 0.065. Site coefficient values of F_a = 1.6 and F_v = 2.4 correspond to the site class and mapped spectral response accelerations.

7.2.4 Lateral Earth Pressures

The parameters shown in Table 4 may be used to evaluate earth pressures on cast-in-place concrete foundation walls and may also be used to evaluate cast-in-place concrete site retaining walls. Cohesive soils, such as the on-site clay bearing soils, should not be used in the backfill zone. The backfill soils should be granular in composition and capable of meeting or exceeding the parameters listed below. Borrow source soils should be tested prior to import to confirm design parameters are satisfied.

Table 4: Lateral Earth Pressures (Level Backfill Conditions)

Material	Approved Granular Soils
Active (K_A)	0.33
At-Rest (K_O)	0.50
Moist Unit Weight – (γ_m)	120 pcf
Cohesion (*C*)	0 psf
Angle of Internal Friction (ϕ')	30°
Coefficient of Friction[A]	0.38

H&P's recommendations assume that a constantly functioning drainage system is installed to prevent the build-up of hydrostatic pressures behind the wall. The drainage system may consist of open-graded #57 stone provided adequate discharge is available. Considering the site is in a karst prone geology, H&P recommends incorporating redundancy in the design in case primary piping becomes clogged thus preventing discharge. Heavy equipment should not be utilized within the construction zone measured at a 45-degree angle from the base of the wall structure. The use of heavy equipment adjacent to retaining walls can result in increased lateral earth pressures and subsequent excess wall movements. Lightweight equipment such as hand-operated tampers should be used for compaction. The effect of surcharge loads should be added to the recommended earth pressures to determine the total applied lateral stress subjected on the wall.

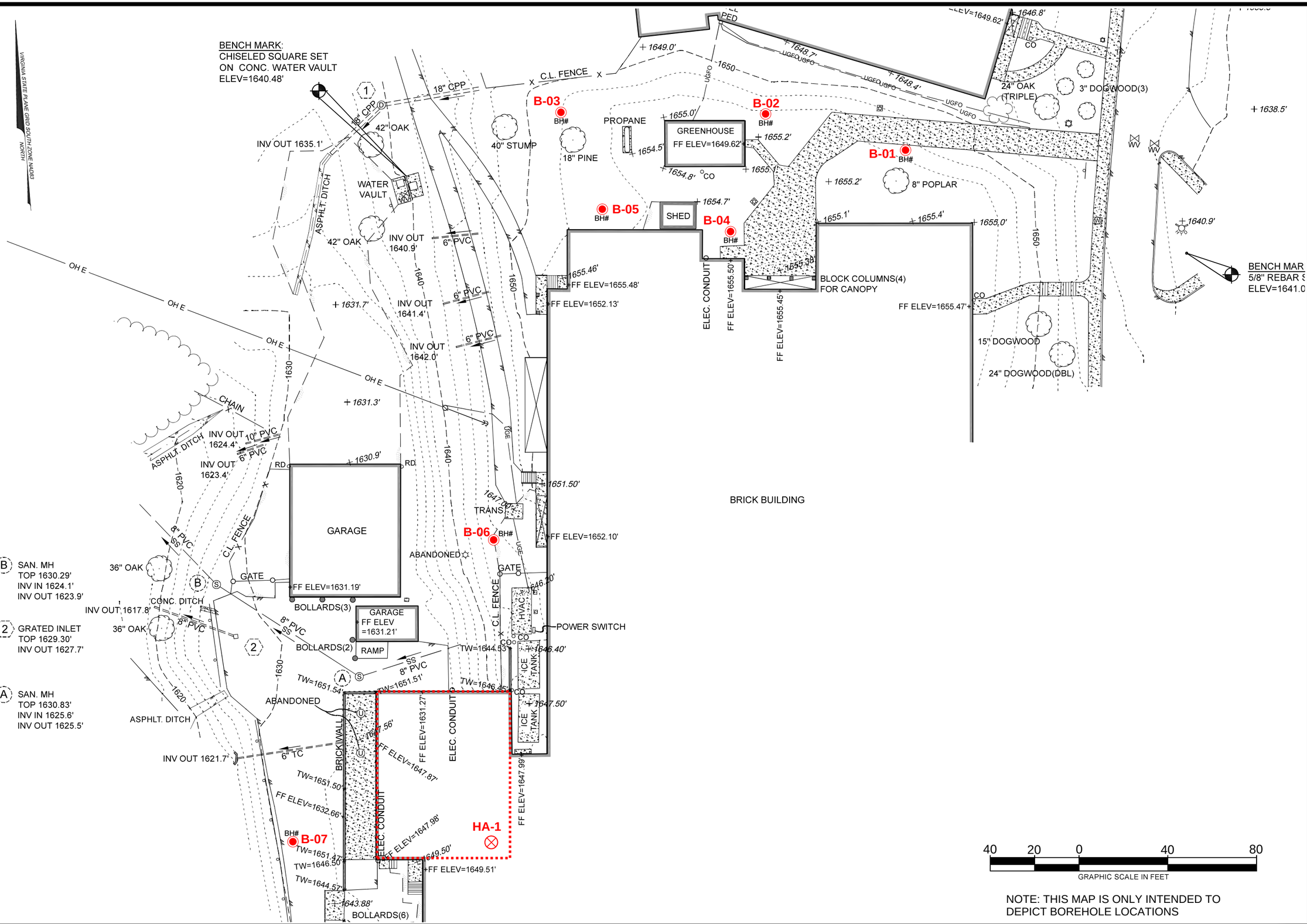
8.0 LIMITATIONS

This report has been prepared for Crabtree, Rohrbaugh & Associates, and their authorized representatives with respect to the proposed Shelburne Middle School Additions project located at 300 Grubert Aveune in Staunton, Virginia. The specific application of this report is to provide general subsurface information to design the foundation system for the above referenced site elements in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. Our conclusions and recommendations are based on the data obtained from the previously described subsurface exploration program, and generally accepted geotechnical engineering practice. The conclusions and recommendations do not reflect variations in subsurface conditions that could exist in unexplored areas of the site. Should such variations become apparent during subsequent investigations and/or during construction, it will be necessary to reevaluate our conclusions and recommendations based upon on-site observations of the conditions.

In the event that changes are made to the location of the proposed additions and other improvements, the recommendations presented in this report shall not be considered valid unless the changes are reviewed by our firm and the conclusions of this report are modified and/or verified in writing. We should also be given the opportunity to review the completed construction plans. This review is generally warranted to ensure that the recommendations and comments provided herein have been understood and properly implemented.

Appendix A

Test Boring Location Map



NOTE: THIS MAP IS ONLY INTENDED TO DEPICT BOREHOLE LOCATIONS

TEST BORING LOCATION MAP

FOR

SHELBURNE MIDDLE SCHOOL ADDITIONS

PITTSYLVANIA COUNTY, VA

PROJECT #:	20220692
LAT.	38°09'37.5"N
LONG.	79°05'56.1"W
DATE:	09/29/2023
DRAWN BY:	H&P
CHECKED BY:	

Test Boring Location (Approximate)

B-# Test Boring Number

ATTACHMENT 1

SHEET #: 1 OF 1

HURT&PROFFITT
INSPIRED / RESPONSIVE / TRUSTED
2524 LANGHORNE ROAD
LYNCHBURG VA 24501
434.847.7796 | HANDP.COM
ENGINEERING • SURVEYING • LAND DEVELOPMENT • ENVIRONMENTAL
GEOTECHNICAL • CONSTRUCTION TESTING & INSPECTION • CULTURAL RESOURCES

THIS SHEET IS INTENDED TO BE REPRODUCED AT 11"X17". REPRODUCTION OF THIS SHEET AT A DIFFERENT SIZE THAN INTENDED SHALL VOID THE SCALE SHOWN ON THE SHEET.

Appendix B

Test Boring Logs

LOG OF BORING B-01

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501
Telephone: (434) 847-7796
Fax: (434) 847-0047
http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/8/2023.

SURFACE ELEVATION: 1654.0
BORING DEPTH (ft): 26.0
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES / BLOW COUNT / PERCENT RECOVERY / R.Q.D. / N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	4 9 24 **33**						12 inches of Topsoil 1.0
	2	50/5" 42 50/4" **50/4"**	1					RESIDUUM: Dense, Grayish Brown Clayey GRAVEL (GM), moist 1.5
	3							Light Gray Silty GRAVEL (GM), contains rock fragments, dry
1650	4							4.0
	5	7 8 4 **12**	23					Stiff, Reddish Brown FAT CLAY (CH), moist
	6	6 5						
	7	4 20 **24**	24					Very Stiff, Sandy
	8	45						
1645	9							9.0
	10	18 30 **58** 28						Very Dense, Gray fine to coarse Silty SAND (SM), moist-dry
	11							
	12							
	13							
1640	14	50/2" **50/2"**						14.0
	15							Partially Weathered Rock: Gray fine to coarse Silty SAND (SM), moist-dry
	16							
	17							
	18							
1635	19							19.0
	20	7 8 **16** 8						Medium Dense, Orangish Brown fine to coarse Clayey SAND (SC), moist-very moist
	21							
	22							
	23							
1630	24							24.0
	25	47 50/3" **50/3"**						Partially Weathered Rock: Gray Silty SAND (SM), contains limestone rock fragments, moist
	26							26.0
								Auger Refusal at 26.0 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 23 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING B-02

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501
Telephone: (434) 847-7796
Fax: (434) 847-0047
http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/8/2023.

SURFACE ELEVATION: 1655.0
BORING DEPTH (ft): 22.3
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES / BLOW COUNT / PERCENT RECOVERY / R.Q.D. / N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	3 / 34 / 50/5" — **50/5"**						4 inches of Topsoil
	2							RESIDUUM: Very Stiff, Gray Silty GRAVEL (GM), contains limestone rock framents — 2.0
	3	6 / 5 / 16 / 15 — **21**	28					Reddish Brown FAT CLAY (CH) with Sand, moist
	4							
1650	5	4 / 9 / 11 — **20**	16					Sandy
	6	7 / 2						
	7	15 / 50/2.5 — **50/2.5**						contains limestone rock fragments
	8							
	9							
1645	10	5 / 6 / 2 — **8**	36					Medium Stiff, with Sand, very moist
	11							
	12							
	13							
	14							14.0
1640	15	12 / 15 / 14 — **29**						Medium Dense, Orangish Brown fine to coarse Clayey SAND (SC), contains rock fragments, moist-very moist
	16							
	17							
	18							
	19							
1635	20	11 / 25 / 25 — **50**						Dense
	21							
	22							22.3
								Auger Refusal at 22.3 feet

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 14 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING B-03

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501
Telephone: (434) 847-7796
Fax: (434) 847-0047
http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/7/2023.

SURFACE ELEVATION: 1652.0
BORING DEPTH (ft): 30.5
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES / BLOW COUNT	PERCENT RECOVERY / R.Q.D. / N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	5 7 7 10	**14**						4 inches of Topsoil
1650	2								RESIDUUM: Medium Dense, Light Olive Brown Silty GRAVEL (GM), moist-dry 2.0
	3	4 6 10	**16**	26					Very Stiff, Orangish Brown Sandy FAT CLAY (CH), moist
	4	9							
	5	4 8 8	**16**	38					with Sand
	6	9							
1645	7	3 6 7	**13**						Stiff
	8	13							
	9								9.0
	10	11 12 9	**21**						Medium Dense, Orangish Brown fine to coarse Clayey SAND (SC), contains rock fragments, moist
	11								
1640	12								
	13								
	14	10							
	15	13 17	**30**	23					
	16								
1635	17								
	18								
	19								19.0
	20	2 6 8	**14**						Stiff, Orangish Brown FAT CLAY (CH), moist
	21								
1630	22								
	23								
	24	7							
	25	6 5	**11**						contains rock fragments
	26								
1625	27								
	28								
	29								29.0
	30	13 10 7	**17**						Medium Dense, Orangish Brown fine to coarse Clayey SAND (SC), contains rock fragments, moist 30.5
									Boring Terminated at 30.5 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 17.8 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING B-04

Hurt & Proffitt, Inc.
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http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/8/2023.

SURFACE ELEVATION: 1655.0
BORING DEPTH (ft): 30.5
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1		13 16								12 inches of Topsoil 1.0
	1		13 12		29						RESIDUUM: Very Stiff, Orangish Brown Sandy FAT CLAY (CH), moist
	2		3 3								Medium Stiff, trace Sand
	3		4 4		7	29					
	4		3 3								
1650	5		5 13		8	27					
	6		4 11								Very Stiff, with Sand
	7		15 11		26	26					
	8										
	9		2 5								
1645	10		5		10						Stiff, Sandy
	11										
	12										
	13										
	14		1 3								
1640	15		3		6						Medium Stiff, very moist
	16										
	17										
	18										
	19		1 2								
1635	20		4		6						with Sand
	21										
	22										
	23										
	24		2 3								
1630	25		12		15						Stiff, trace Sand
	26										
	27										
	28										
	29		5 4								29.0
1625	30		5		9						Loose, Orangish Brown fine to coarse Clayey SAND (SC), contains limestone rock fragments, very moist 30.5
											Boring Terminated at 30.5 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 19.4 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING B-05

Hurt & Proffitt, Inc.
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Telephone: (434) 847-7796
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http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/8/2023.

SURFACE ELEVATION: 1654.0
BORING DEPTH (ft): 40.5
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1		9 21 22 27		43						12 inches of Topsoil — 1.0
	2		9 8 11 11		19	29					RESIDUUM: Dense, Light Olive Brown fine to coarse Clayey SAND (SC), moist — 2.0
	3					19	47	23	24	62	Very Stiff, Orangish Brown FAT CLAY (CH) with Sand, very moist
1650	4		3 3 3 3		6	30					Medium Stiff, trace Sand
	5										
	6		6 2 3 4		7						Sandy
	7		11								
	8										
1645	9		4 16 8		24	30					Very Stiff, with Sand
	10										
	11										
	12										
	13										
1640	14		19 9 5		14	38					Stiff
	15										
	16										
	17										
	18										
1635	19		3 5 50/3"		50/3"						19.0 — Very Dense, Orangish Brown Brown fine to coarse Clayey SAND (SC), contains rock fragments, very moist
	20										
	21										
	22										
	23										
1630	24		5 14 13		27						Medium Dense
	25										
	26										
	27										
	28										
1625	29		1 2 2		4						29.0 — Soft, Orangish Brown FAT CLAY (CH) with Sand, very moist
	30										
	31										
	32										

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 22 feet

LOG OF BORING B-05

Hurt & Proffitt, Inc.
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http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/8/2023.

SURFACE ELEVATION: 1654.0
BORING DEPTH (ft): 40.5
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
1620		33										Soft, Orangish Brown FAT CLAY (CH) with Sand, very moist *(continued)*
		34		2								
		35		1		2						
		36		1								
		37										
		38										
1615		39										39.0
		40		23								Medium Dense, Grayish Brown fine to coarse Silty SAND (SM), contains rock fragments, moist-dry
				10		14						40.5
				4								Boring Terminated at 40.5 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 22 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING B-06

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501
Telephone: (434) 847-7796
Fax: (434) 847-0047
http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/7/2023.

SURFACE ELEVATION: 1645.0
BORING DEPTH (ft): 27.7
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. / N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0		3							6 inches of Gravel
	1		2 3 3	**5**						**PROBABLE FILL:** Loose, Brown fine to coarse Clayey SAND (SC), contains rock fragments, moist
	2		1 1 3		17					
	3		2	**4**	27	54	27	27	84	Very Loose
	4		2 4 5							4.0
1640	5		6	**9**						RESIDUUM: Stiff, Orangish Brown FAT CLAY (CH)), moist
	6		1 1		35					
	7		3 4	**4**						Soft, moist-very moist
	8									
	9		1							
1635	10		3 5	**8**						Medium Stiff
	11									
	12									
	13									
	14		WOH							
1630	15		1 1	**2**	40					Soft, very moist
	16									
	17									
	18									
	19		WOH/18"							
1625	20			**WOH/18"**						Very Soft
	21									
	22									
	23									
	24									24.0
1620	25		14 23 23	**46**						Dense, Gray Silty GRAVEL (GM), contains rock fragments, dry
	26									
	27									27.7
										Auger Refusal at 27.7 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 22 feet

LOG OF BORING B-07

Hurt & Proffitt, Inc.
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http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 8/7/2023.

SURFACE ELEVATION: 1631.0
BORING DEPTH (ft): 30.5
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 inches of Asphalt and 8 inches of Stone Base Course (1.0)
1630	1										
	2		1 2 6		8						**PROBABLE FILL:** Loose, Grayish Brown fine to coarse Clayey SAND (SC), moist
	3										
	4		13 2 5		8	19					
	5		3 5								(5.0)
1625	6		1 3 3 6		6	37					Medium Stiff, Reddish Brown FAT CLAY (CH), moist
	7										
	8										
	9		1 2 3 13		5	37					Orangish Brown
	10										
1620	11										
	12										
	13										
	14		2 3 5		8						
	15										
1615	16										
	17										
	18										
	19		1 2 3		5						very moist
	20										
1610	21										
	22										
	23										
	24		2 4 5		9						Stiff
	25										
1605	26										
	27										
	28										(28.0)
	29		19 30 11		41						Dense, Olive Grayish Brown Silty SAND (SM), contains rock fragments, moist-dry
	30										(30.5)
											Boring Terminated at 30.5 feet.

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 21.4 feet

BORING LOG-GC 20220692.GPJ 10/3/23

LOG OF BORING HA-1

Hurt & Proffitt, Inc.
2524 Langhorne Road
Lynchburg, VA 24501
Telephone: (434) 847-7796
Fax: (434) 847-0047
http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

DRILLING DETAILS:
Drilled by D. Cash using Hand Auger and Dynamic Cone Penetrometer. Boring completed 8/7/2023.

SURFACE ELEVATION: 1647.7
BORING DEPTH (ft): 7.8
PROPOSED SUBGRADE ELEVATION:

GROUNDWATER DEPTH AT COMPLETION (ft):
GROUNDWATER DEPTH AFTER 24 HRS (ft):

ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT / PERCENT RECOVERY / R.Q.D. / N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
										5 inches of Concrete
		1			16					RESIDUUM: Stiff, Orangish Brown fine to coarse Clayey SAND (SC), contains rock fragments, moist DCP at minus 1-foot = 25+
		2								2.0
1645		3			32					Orangish Brown FAT CLAY (CH), moist DCP at minus 2 feet = 14, 12, 12 DCP at minus 3 feet = 10, 13, 13
		4								DCP at minus 4 feet = 12, 12, 12
		5			27					with Sand DCP at minus 5 feet = 9, 10, 17
		6								DCP at minus 6 feet = 8, 12, 14
		7								DCP at minus 7 feet = 17, 19, 23
1640										7.8
										Hand Auger Refusal at 7.8 feet.

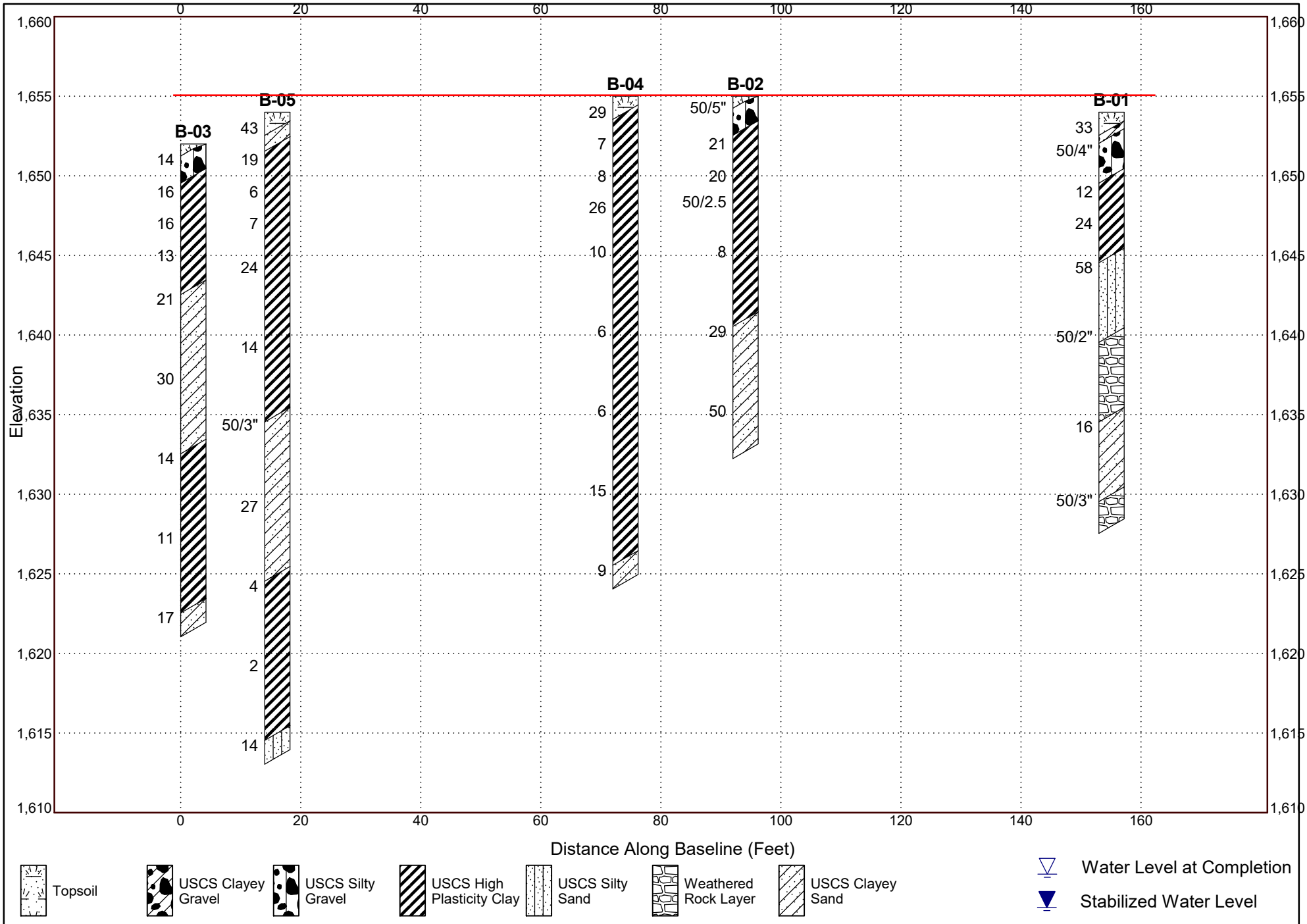
N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Performed inside an existing building. Elevation estimated as FFE

BORING LOG-GC 20220692.GPJ 10/3/23

Appendix C

Boring Profiles

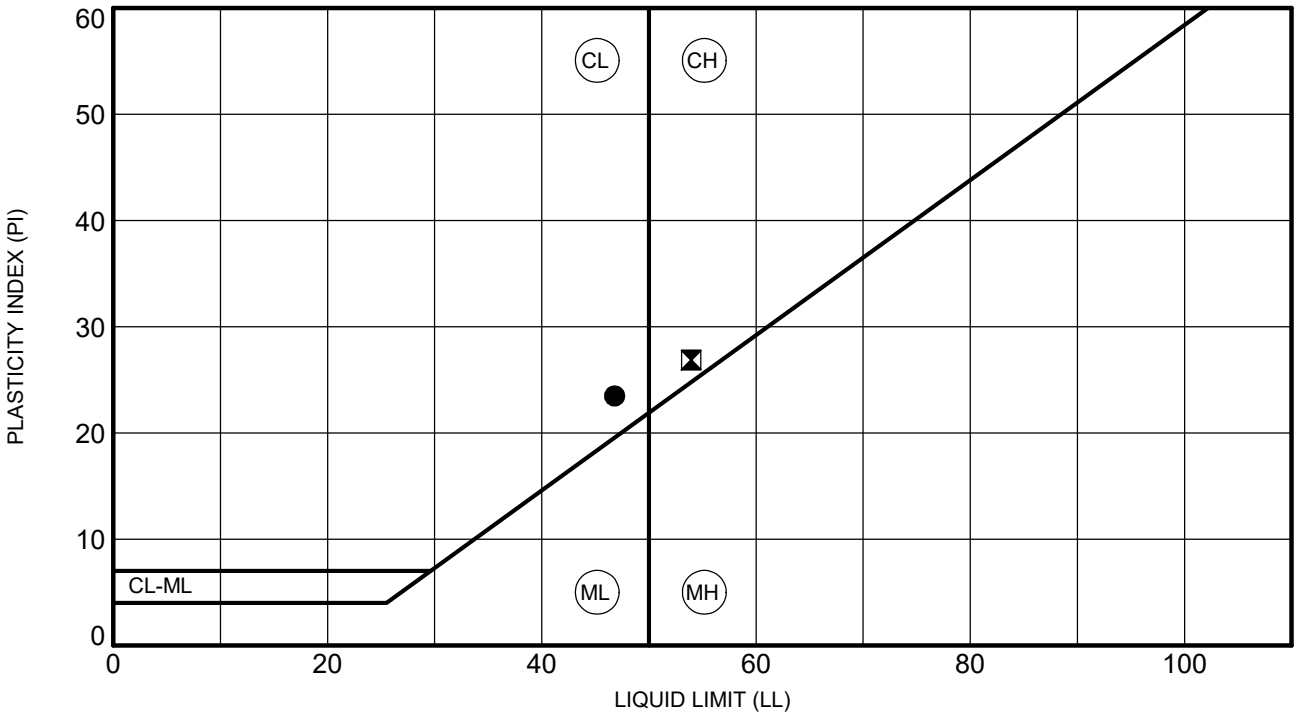


BORING PROFILE DIAGRAM	Shelburne Middle School	H&P PROJECT #	DATE
		20220692	Oct 2023

Appendix D

Atterberg Limits & Sieve Results

ATTERBERG LIMITS' RESULTS

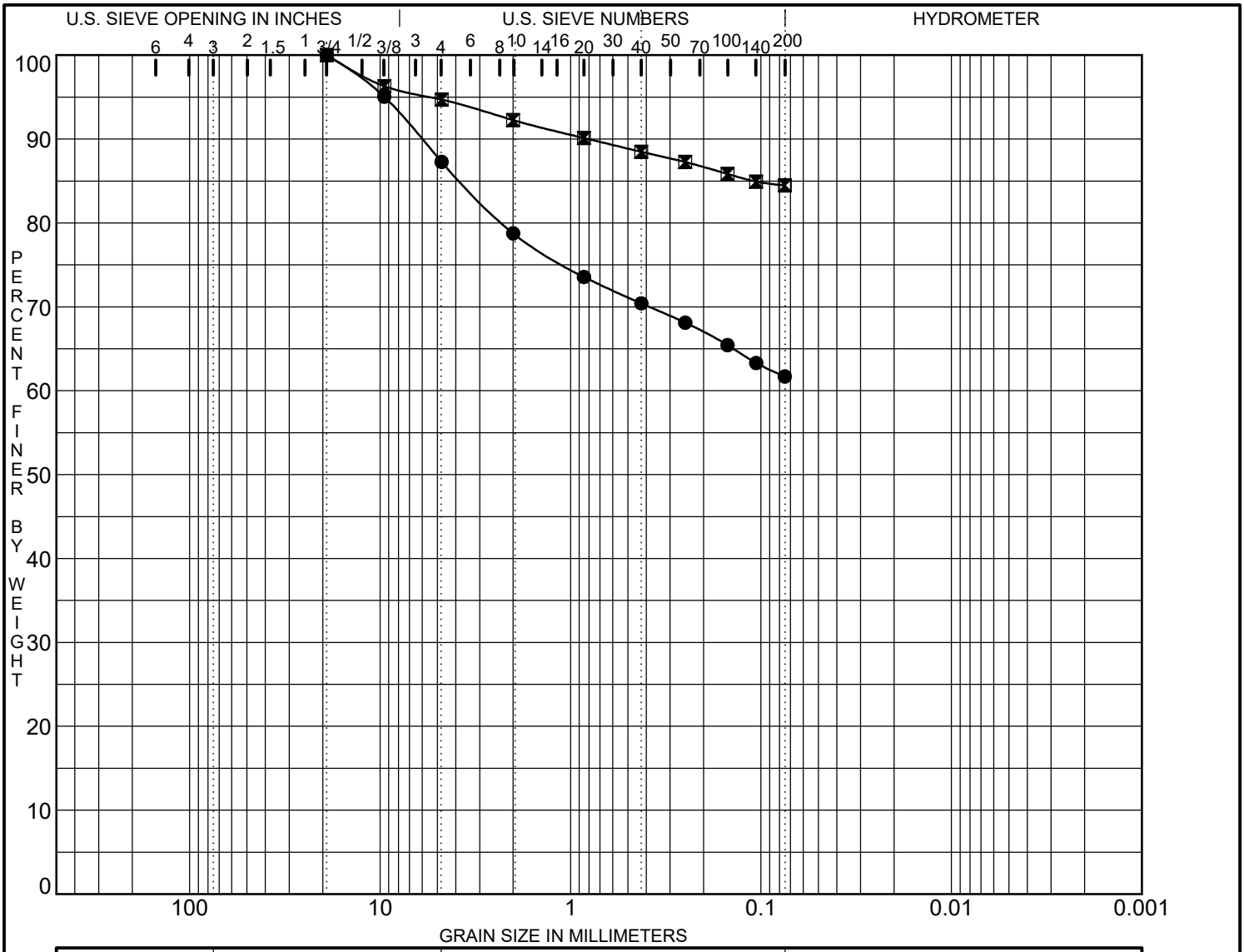


	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-05	4.0	47	23	24	61.7	Yellowish Red SANDY LEAN CLAY (CL)
⧓	B-06	4.0	54	27	27	84.5	Yellowish Red FAT CLAY with SAND (CH)

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CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI
●	B-05	4.0	Yellowish Red SANDY LEAN CLAY (CL)	19.0	47	23	24
⧓	B-06	4.0	Yellowish Red FAT CLAY with SAND (CH)	27.4	54	27	27

	Specimen Identification		D100	D60	D30	D10	Cc	Cu	%Gravel	%Sand	%Silt	%Clay
●	B-05	4.0	19.00						12.7	25.6	61.7	
⧓	B-06	4.0	19.00						5.3	10.2	84.5	

SIEVE 20220692.GPJ 10/2/23

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Fax: (434) 847-0047
http://www.HandP.com

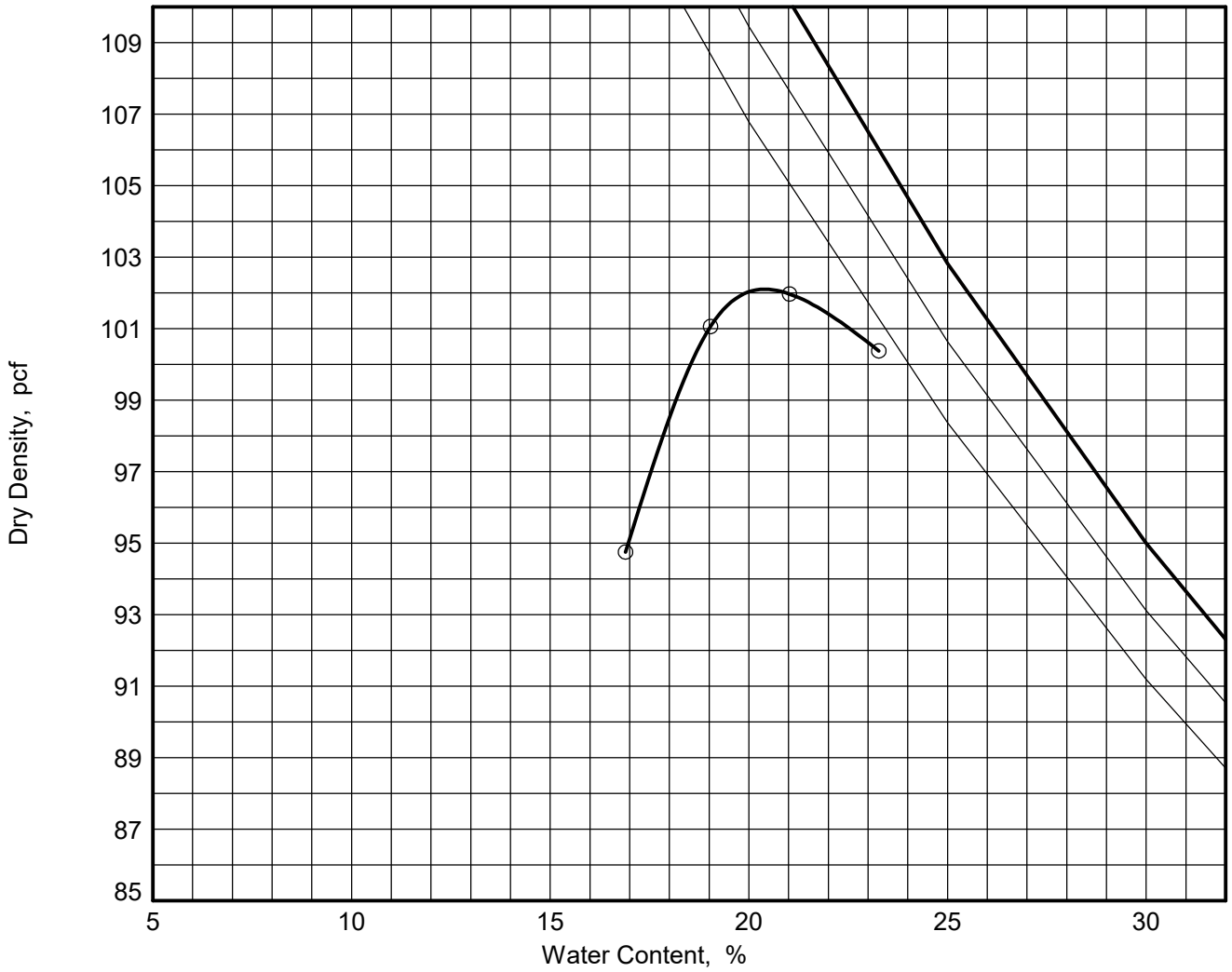
CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

Appendix E

Standard Proctor Results

MOISTURE - DENSITY RELATIONSHIP



Standard Proctor - ASTM D 698, Method A, using the Dry Preparation method and Manual Rammer

MATERIAL DESCRIPTION	AASHTO	SAMPLE ID: **B-06**
Yellowish Red FAT CLAY with SAND (CH)	A-7-6(18)	Maximum Dry Density = **102.2 pcf** Optimum Moisture = **20.3 %**

Natural Moisture	Specific Gravity	Liquid Limit	Plasticity Index	% < 3/4 in.	% < 3/8 in.	% < No. 4	% < No. 200
27.4		54	27	100.0	96.3	94.7	84.5

Sampled by D. Cash August 7, 2023
Sample location: B-6 (Depth 2'-6')
Proposed use:

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http://www.HandP.com

CLIENT: Crabtree Rohbaugh & Associates Architects
PROJECT: Shelburne Middle School
LOCATION: Staunton, Virginia

PROJECT NO. 20220692

Appendix F

CBR Results

HURT&PROFFITT

Project Name:	Shelburne Middle School
Project #:	20220692
Location:	B-6 (Depth 2'-6')
Date:	October 3, 2023
Sample ID:	1

California Bearing Ratio Computations (VTM-8 Modified)

Soil Description: Yellowisih Red Fat Clay with Sand (CH)
Liquid Limit: 54
Plasticity Index: 27

Minus 200 (%): 84.5
Proctor Density (pcf): 102.2
Optimum Moisture (%): 20.3

Computed Weight of Compacted Soil in CBR Mold

0.075	x	102.2	=	7.67	lbs, weight of dry soil
453.6	x	7.67	=	3477	grams, weight of dry soil
3477	x	1.203	=	4183	grams, weight of wet soil

Actual Weight and Density of Soil in CBR Mold

	Soaked Mold (s)	Soaked Mold After Immersion (i)	
Wt. of mold and wet soil	11171	11331	grams
Wt. of mold	7015	7015	grams
Wt. of wet soil (S_w)	4156	4316	grams
Moisture content (w)	20.0	30.4	percent
Wt. of dry soil	3464	3310	grams
Percent Density Obtained:	99.6 %	92.2 %	

Compaction Effort
3 Layers
56 Blows/Layer

Mold ID: # 6

Density (D) = S_w / (V x (1+w) x 453.6), w is expressed as a decimal

D_S = 101.8 V_s = 0.0750 w = 0.200
D_I = 94.2 V_i = 0.0774 w = 0.304

V_i = resulting volume after soak, $V_i = [(1/4\pi d^2) \times (ho + \Delta h)] \times 0.0005787$

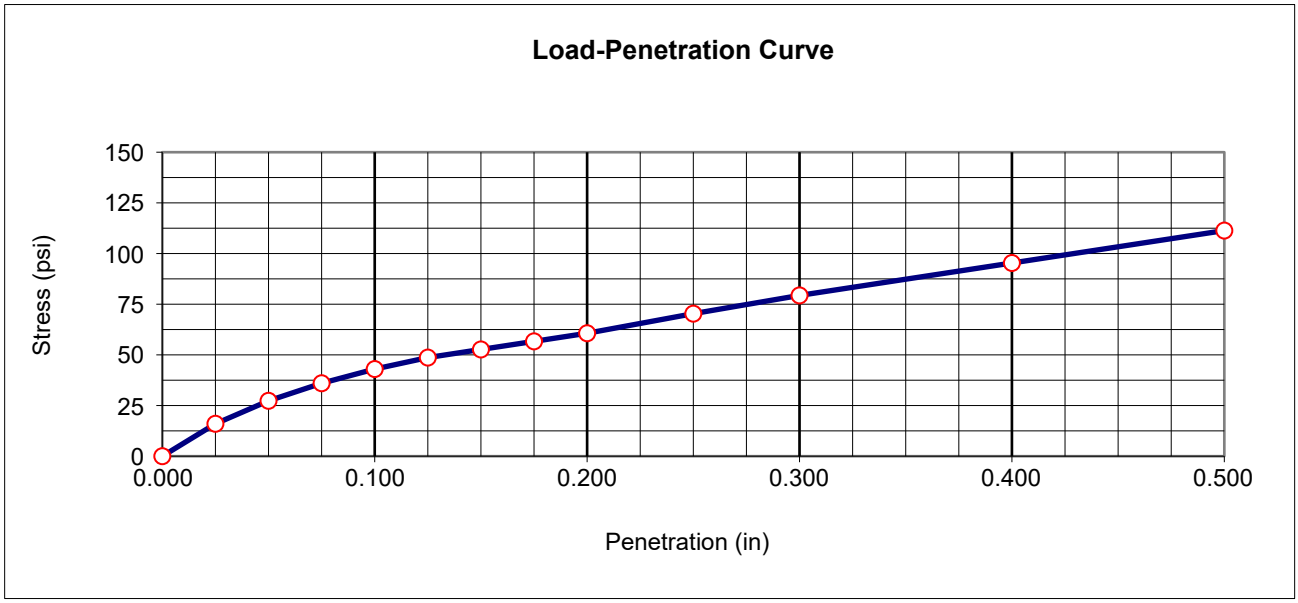
Computation of Swell

Reading before immersion	0.011	
Reading after immersion	0.160	points
Amount of Swell	0.149	points

% Swell = 3.25

Determination of CBR Value (Penetration and Total Load)

Inches	0.000	0.025	0.050	0.075	0.100	0.125	0.150	0.175	0.200	0.250	0.300	0.400	0.500
Stress on Piston (psi)	0	16	27	36	43	49	53	57	61	70	79	95	111
Total load after 4 day soak	0	48	82	108	129	146	158	170	182	211	238	286	334



CBR Value (0.1") = 4.3 %
CBR Value (0.2") = 4.0 %

Appendix G

Expansion Index Results

EXPANSION INDEX REPORT

ASTM D 4829

2524 LANGHORNE ROAD
LYNCHBURG, VA 24501
800-242-4906
www.HandP.com

PROJECT: Shelburne Middle School
DATE SAMPLED: 8/8/2023
CLIENT: Crabtree Rohbaugh & Associates Architects
DATE TESTED: 9/6/2023
H&P REPRESENTATIVE: K. Meritt
PROJECT NO: 20220692

SAMPLE LOCATION: B-5 (Depth 2'-6')

SOIL DESCRIPTION: Yellowish Red Sandy Lean Clay (CL)

Field Moisture = 18.96%

MOISTURE/DENSITY DETERMINATION	
Wt. of Empty Dish (g)	6.89
Wt. of Dish & Wet Soil (g)	141.58
Wt. of Dish & Dry Soil (g)	126.67
% Moisture	12.4
Wt. of Mold (g)	365.78
Wt. of Mold & Wet Soil (g)	739.29
Wt. of Wet Soil (g)	373.51
Ring Volume (ft^3)	0.00725
Wet Density (lbs/ft^3)	113.6
Dry Density (lbs/ft^3)	101.0

% SATURATION CALCULATIONS	
Specific Gravity	2.7
% Moisture	12.4
Dry Density (lbs/ft^3)	101.0
(S), % Saturation	50.3

EXPANSION INDEX CALCULATIONS

Initial Height (H_1 = 1.000 in)	Dial reading (in)	Time (hr:min)	Date
D_1	0.0083	10:14 AM	9/6/23
D_2	0.0265	10:30 AM	9/6/23
D_3	0.0273	12:30 PM	9/6/23
D_4	0.0275	2:30 PM	9/6/23
D_5	0.0276	3:30 PM	9/6/23
D_6	0.0276	4:30 PM	9/6/23

Expansion Index (EI_{meas})	19	Final Moisture %	24.2%
Expansion Index (EI_{50})	19	% +4 Material	<5 %
Potential Expansion	Very Low		

EXPANSION INDEX REPORT

ASTM D 4829

2524 LANGHORNE ROAD
LYNCHBURG, VA 24501
800-242-4906
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PROJECT: Shelburne Middle School
DATE SAMPLED: 8/8/2023
CLIENT: Crabtree Rohbaugh & Associates Architects
DATE TESTED: 9/6/2023
H&P REPRESENTATIVE: K. Meritt
PROJECT NO: 20220692

SAMPLE LOCATION: B-6 (Depth 2'-6')

SOIL DESCRIPTION: Yellowish Red Fat Clay with Sand (CH)

Field Moisture = 27.43%

MOISTURE/DENSITY DETERMINATION	
Wt. of Empty Dish (g)	6.85
Wt. of Dish & Wet Soil (g)	184.90
Wt. of Dish & Dry Soil (g)	164.06
% Moisture	13.3
Wt. of Mold (g)	366.00
Wt. of Mold & Wet Soil (g)	735.66
Wt. of Wet Soil (g)	369.66
Ring Volume (ft^3)	0.00725
Wet Density (lbs/ft^3)	112.4
Dry Density (lbs/ft^3)	99.2

% SATURATION CALCULATIONS	
Specific Gravity	2.7
% Moisture	13.3
Dry Density (lbs/ft^3)	99.2
(S), % Saturation	51.3

EXPANSION INDEX CALCULATIONS

Initial Height (H_1 = 1.000 in)	Dial reading (in)	Time (hr:min)	Date
D_1	0.0035	10:14 AM	9/6/23
D_2	0.0366	10:30 AM	9/6/23
D_3	0.0378	12:30 PM	9/6/23
D_4	0.0381	2:30 PM	9/6/23
D_5	0.0383	3:30 PM	9/6/23
D_6	0.0384	4:30 PM	9/6/23

Expansion Index (EI_{meas})	35	Final Moisture %	24.2%
Expansion Index (EI_{50})	36	% +4 Material	<5 %
Potential Expansion	Low		

SECTION 011000 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Temporary Facilities & Controls” for requirements for temporary utilities, support facilities, and security and protection.

1.3 PROJECT INFORMATION

A. The following is information related to the Project.

1. Project Location: Shelburne Middle School Additions and Renovations
   300 Grubert Ave, Staunton, VA
2. Owner: School Board of the City of Staunton, VA
   116 W Beverley Street Staunton, VA 24401
3. Project Consultants:
   a. Mechanical, Electrical and Plumbing Engineers
      CMTA
      315 W Broad St Richmond, VA 23220
   b. Structural Engineer
      Dunbar Milby Williams Pittman & Vaughan
      110 Third St N.E. Charlottesville, VA 22902
   c. Civil Engineer
      Foresight Design Services
      1260 Radford St Christiansburg, VA 24073

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of selective demolition of portions of the existing high school, complete demolition of the two classroom wings on the south portion of the building, construction of a new four story classroom wing, administration and commons area, and a new auxiliary gymnasium.

B. The Contract Documents, dated February 5, 20224 were prepared for the Project by Crabtree, Rohrbaugh & Associates, 250 W. Main St Charlottesville, VA 22902, phone: (434) 975 7262, fax: (717) 458-0047.

1.5 CONTRACTS

A. The Project will be constructed under a single prime-contracting contract arrangement.

	CONTRACT NAME	CONTRACT NUMBER	ABBREVIATION
1.	General Construction	3636-1	GC

The Owner reserves the right to award additional prime contracts or to perform construction operations with its own forces on portions of the Project.

B. Contract Work: The Work of this contract is summarized as follows:

1. **General Construction Contract 3636-1**: The General Construction Contract includes all work of this Project.

1.6 PHASED CONSTRUCTION

A. The Work of this Project shall be conducted in three (3) phases, with each phase substantially complete as indicated.

1. Refer to Division 1 Section “Construction Progress Documentation” for the Project Phasing Narrative and to the Contract Drawings for the Project Phasing Plan.

1.7 WORK BY OWNER

A. General: Cooperate fully with the Owner so Work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by the Owner. Coordinate the Work of this Contract with work performed by the Owner.

B. Concurrent Work: The Owner will perform the following construction operations at the Project site. These operations will be conducted simultaneously with Work under this Contract.

1. The Owner will be installing N.I.C. low voltage systems concurrently with the contracted work.

1.9 PRIME CONTRACTORS USE OF PREMISES

A. General: During the construction period the contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the Site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, users, deliveries and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.10 OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: The Owner may occupy and place installed equipment in completed areas of the building prior to Substantial Completion. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. The Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner occupancy.
2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions of the building.
4. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building.

1.11 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with the following restrictions on construction operations.

1. Comply with limitations on the use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit on-site Work to normal business working hours of 7:00am – 5:00pm Monday through Friday, unless otherwise indicated. All Work performed during non-normal business hours must be coordinated with and approved by the Owner a minimum of 48 hours prior to the Work being performed. Contractor shall review the City noise ordinance and comply with all requirements. The Owner will not pay for any noise ordinance fines.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify the Owner not less than 72 hours in advance of proposed utility interruptions.
2. Obtain the Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors or other disruptions to the Owner.

1. Notify the Owner not less than 48 hours in advance of proposed disruptive operations.
2. Obtain the Owner's written permission before proceeding with disruptive operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011000

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Unit Prices.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 1 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. A Unit Price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of work or estimated quantities of work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual specification sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3 of this section. Specification sections referenced in the schedule contain requirements for materials described under each unit price.

E. The intended purpose of Unit Prices is to pre-establish a unit cost for small or incidental scopes of work. If quantities originally contemplated are materially changed so that application of such unit prices will cause a substantial inequity to the Owner or Contractor, the Owner reserves the right to equitably adjust the Unit Price or to require that the work be performed on a time and material basis.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. UNIT PRICES

GC-1: Bulk Soil Excavation.

1. Description: Bulk excavation of unsatisfactory soil and disposal off site as required in accordance with Division 2 Section "Earthwork."
2. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.

GC-2: Borrow Soil Replacement.

1. Description: Borrow soil replacement, placement and compaction with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 2 Section "Earthwork."
2. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.

GC-3: Trench Rock Removal and Replacement with Satisfactory Material.

1. Description: Classified trench rock removal and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 2 Section "Earthwork."
2. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed.

GC-4: Bulk Rock Removal and Replacement with Satisfactory Material.

1. Description: Classified bulk rock removal and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 2 Section "Earthwork."
2. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed.

GC-5: Cutting and Patching of Concrete Floor Slabs.

1. Description: Cutting of new or existing concrete floor slabs up to 6 inches thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete in accordance with Division 1 Section "Cutting and Patching" not otherwise indicated in the Contract Documents.
2. Unit of Measurement: Square foot of concrete removed.

GC-6: Cementitious Underlayment.

1. Description: Provide an average 1/4-inch thickness of cementitious underlayment above what is stated in the contract documents.
2. Unit of Measurement: Square foot.

GC-7: Repointing of Existing Brickwork.

1. Description: Removal of existing mortar by mechanical means and replacement with new mortar to match the color and tooling of existing mortar to remain. The General Contractor shall provide a cost per sq. ft. for cleaning and re-pointing existing face masonry. The General Contractor shall include, with their base bid, 2000 sq. ft. of re-pointing of existing face masonry in locations agreed upon in the field between the Contractor, Architect, and Owner. The sq. ft. cost will then be used to calculate a change order amount if more than 2000 sq. ft. is needed or as a credit to the Owner if less than 2000 sq. ft. is needed.
2. Unit of Measurement: Square foot.

GC-8: Cleaning of existing brick.

1. Description: Cleaning of existing brick as stated in Section 042000 Unit Masonry Assemblies Paragraph 3.16.D. The General Contractor shall include, with their base bid, 1000 sq. ft. of cleaning of existing face masonry in locations agreed upon in the field between the Contractor, Architect, and Owner. The sq. ft. cost will then be used to calculate a change order amount if more than 1000 sq. ft. is needed or as a credit to the Owner if less than 1000 sq. ft. is needed.
2. Unit of Measurement: Insert unit of measurement.

GC-9: Trench Soil Removal and Replacement with Compacted 2A Stone.

1. Description: Trench excavation of unsatisfactory soil and disposal off site as required in accordance with Division 2 Section "Earthwork."
2. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

A. Definition: An alternate is an amount proposed by a bidder and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the NET addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each Alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other Work of the Contract.

D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATES

ALT #1 Multi-Purpose Room Addition: State the amount to be added to the Contract to provide all General Construction labor and materials to construct the Addition of the Multi-Purpose Room and associated renovations as shown throughout the drawings as Alternate #1.

ALT #2 Renovations – Administration Area: State the amount to be added to the Contract to provide all General Construction labor and materials to construct renovations of the Administration Area as shown throughout the drawings as Alternate #2.

ALT #3 Masonry Wall Repair: State the amount to be added from the Contract to provide all General Construction labor and materials to repair the masonry on the existing site retaining walls in all locations shown on the Exterior Elevations – Renovation sheet A2.1 as ALT #3.

ALT #4 Multi-Purpose Room Addition Unclassified Excavation - : State the amount to be added to the Contract to provide all Unclassified Excavation labor and materials to construct the Addition of the Multi-Purpose Room. The base bid shall be Classified Excavation.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

A. The Definitions in this Article do not change or modify the meaning of other terms used throughout the Contract Documents.

B. Substitution: Products considered to be able to perform the same function but that do not necessarily have the same design, arrangement, details, utility requirements and/or dimensions, etc.

C. Approved Equal: Products of equivalent design, arrangement, details, utility requirements and/or dimensions, etc., produced by a manufacturer not specifically listed in the “Manufacturers” Article of a Specification Section.

1. Unless otherwise noted, Approved Equal products may be included in the Bid without additional approval by the Architect.

D. The following are not considered to be requests for substitution:

1. Revisions to the Contract Documents requested by the Owner or the Architect
2. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities having jurisdiction

1.4 SUBSTITUTIONS

A. Substitution Request: The Architect will consider requests for substitutions if received within 60 days AFTER the Notice to Proceed. Requests received more than 60 days after the Notice to Proceed may be considered or rejected at the sole discretion of the Architect. The Architect

will only consider requests for substitution submitted by the Contractor. No substitution requests will be considered from manufacturer's representatives or product vendors unless submitted through the Contractor. **No substitution requests will be considered during the bid period. Bids shall be based on products from one of the manufacturers specified or an "approved equal" product.**

1. Transmit three (3) copies of each request for substitution for consideration. Requests shall be on the Substitution Request Form found at the end of this Section. Requests not meeting this procedural requirement will be returned with **no action taken.**
2. Identify the product to be substituted in each request. Include the related Specification Section and Drawing number. Only one substitution request will be considered per Substitution Request Form.
3. Respond to and attach all of the following items to the Substitution Request Form:

    a. Coordination information, including a list of changes or modifications needed to other parts of the Work to accommodate the proposed substitution.
    b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability and aesthetic effect
    c. Product data, including drawings and descriptions of products
    d. Samples, where applicable or requested
    e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on the overall Contract Time.
    f. Cost information, including a proposal of the net change, if any in the Contract Sum. Substitutions requests submitted more than 60 days after Notice to Proceed must be accompanied by a credit proposal.
    g. The Contractor's certification that the proposed substitution conforms to all requirements of the Contract Documents in every respect and is appropriate for the application indicated.
    h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
    i. The Contractor's Certification that all costs of other Prime Contractors which are covered by the substitution will be borne by the substituting Contractor.

4. Architect's Action: The Architect will notify the Contractor of acceptance or rejection of the substitution within two (2) weeks of receipt of the substitution request. If necessary, the Architect will request additional information or documentation for evaluation within one (1) week of receipt of a request.

    a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated. Following acceptance of the substitution, the Contractor shall submit related information and product data in accordance with Division 1 Section "Submittals".
    b. No claim for additional cost or time will be considered as a result of time for considering substitutions by the Contractor.

B. Conditions for Consideration: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as solely determined

by the Architect. Requests will be returned with **no action taken** if none of the following conditions are satisfied.

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The specified product cannot be provided within the Contract Time. The Architect will not consider a substitution request if the specified product cannot be provided as a result of the Contractor's failure to pursue the Work promptly.
4. The requested substitution offers the Owner a substantial advantage, in cost, time, or energy conservation.
5. The specified product cannot receive necessary approval by a governing authority.
6. The specified product cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
7. The specified product cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
8. The specified product cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

C. Conditions for Acceptance: Following evaluation by the Architect and in accordance with a Change Order, the Contractor may make a substitution only with the consent of the Owner.

END OF SECTION 012500

SUBSTITUTION REQUEST FORM

(Attach to all requests for substitution)

PROJECT NAME
AND NUMBER_____

ARCHITECT



Crabtree, Rohrbaugh & Associates Architects
250 West Main Street, Suite 200
Charlottesville, Virginia 22902
Phone: (866) 458-0272

SECTION	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____

PROPOSED SUBSTITUTION

_____

The attached includes product data, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request. Applicable portions of the data are clearly identified.

The attached data also includes a description of changes to the Contract Documents which the requested substitution will require for its proper installation.

The Contractor certifies that the following paragraphs, unless modified on attachments, are correct:

1. The requested substitution does not affect the dimensions shown on the Drawings.
2. The requested substitution does not change the building design, including engineering design or detailing.
3. The requested substitution has no adverse effect (including additional scope of work or cost increase) on any other subtrades of the Work, on the Contractor's Construction Schedule or any specified warranty requirements.
4. Maintenance and service parts will be locally available for the requested substitution.
5. The requested substitution offers the Owner a substantial advantage, in cost, time, or energy conservation.

The Contractor further certifies that the function, appearance, quality and warranty of the requested substitution are equivalent or superior to those of the specified item.

CONTRACTOR'S CERTIFICATION:

Signature: _____ Date:_____

Firm: _____

Address: _____

Proposed Credit: $_____

Attachments:

SECTION 012600 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
3. Division 1 Section "Substitutions" for administrative procedures for handling requests for substitutions.

1.3 MINOR CHANGES IN THE WORK

A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time.

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1 Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
2 Within 14 calendar days of receipt of a proposal request, submit a detailed estimate of costs necessary to execute the change to the Architect for the Owner's review.

a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
b. Include the costs of labor and supervision DIRECTLY attributable to the requested change. The Contractor’s proposal MUST include hours and applicable rates.

c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
d. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

B. Contractor-Initiated Proposal Requests: When latent or unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a detailed request for a change to the Architect.

1 Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2 Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3 Include the costs of labor and supervision DIRECTLY attributable to the requested change. The Contractor's proposal MUST include hours and applicable rates.
4 Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
5 Comply with requirements in Division 1 Section "Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1 The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine a change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor.

END OF SECTION 012600

SECTION 012700 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Field verify existing conditions prior to proceeding with cutting and patching. Notify the Architect in writing of any conditions that are significantly different from those indicated on the Drawings.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Project Coordination” for procedures for coordinating cutting and patching with other construction activities, and for required coordination drawings.
2. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
3. Division 1 Section “Project Meetings” for meeting procedures for the required Cutting and Patching Conference.
4. Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
5. Division 7 Section "Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore surfaces to original conditions after installation of other Work.

1.4 GENERAL

A. Build sleeves and anchors into the Work for the proper engagement of the Work.

B. Coordinate and provide chases, openings and recesses in new Work to avoid cutting and patching to the greatest extent possible.

C. Perform all cutting necessary to install Work. Cutting of structural members will not be permitted except by written permission of the Architect.

D. Repair at own expense, all surfaces cut into or damaged as a result of Work.

E. All cutting and patching that is unnecessary, excessive or carelessly done, and cutting of new construction made necessary by ill-timed Work shall be repaired at own expense. All such repairing shall be accomplished by skilled mechanics of the proper trade and to the satisfaction of the Architect.

1.5 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least seven (7) days prior to the required Cutting and Patching Conference described below, requesting approval to proceed. Include the following information:

1. Describe the extent of cutting and patching, show how it will be performed, and indicate why it cannot be avoided.
2. Describe anticipated results or changes to in-place construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform the Work.
4. Indicate dates when cutting and patching will be performed.
5. List utility services and mechanical and electrical systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
6. Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Means and methods of all cutting and patching Work shall be the sole responsibility of the Contractor.
8. Obtain approval of the cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory Work.

1.6 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers

3. Mechanical systems, piping and ducts.
4. Fire protection systems
5. Control systems.
6. Communication systems.
7. Conveying systems
8. Electrical wiring systems.
9. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include, but are not limited, to the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior storefront construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise and vibration control elements and systems.

D. Visual Requirements: Do not cut and patch construction exposed on the exterior, in occupied spaces, or in other exposed to view locations in a manner, in the Architect's sole opinion, that results in visual evidence of cutting and patching or that would otherwise reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Meet at the Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review the previously submitted Cutting and Patching Proposal and areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding with Work.

1.7 WARRANTY

A. Warranties: Remove, replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the greatest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that in the Architect's opinion, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Utility Services and Mechanical/Electrical Systems: Where services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled mechanics and workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete cutting and patching operations without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Cut or drill finished surfaces from the exposed or finished side into concealed surfaces.
3. Cut concrete and masonry using a cutting machine such as an abrasive saw or a diamond-core drill.
4. For excavating and backfilling, comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. For mechanical and electrical services, cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with seams that are invisible. Provide materials and comply with installation requirements specified in other Sections.

1. Test and inspect patched areas after completion to demonstrate integrity of installation.
2. Restore exposed finishes of patched areas and extend finish into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces. Provide a sound, even surface of uniform color and appearance.

    a. Where patching occurs in a smooth, painted surface, extend final paint coat over entire unbroken surface containing the patch.
    b. Clean and properly prepare surfaces, piping, conduit, and similar features before applying paint or other finishing materials.
    c. Restore damaged pipe covering to its original condition.

D. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty and similar materials.

END OF SECTION 012700

SECTION 012800 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:

1. Professional surveying services

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Project Coordination" for procedures for coordinating field engineering with other construction activities.

1.3 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in Virginia, to perform required land-surveying services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify layout information shown on the Drawings in relation to the property survey and existing benchmarks before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

B. Establish and maintain a minimum of two (2) permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations with horizontal and vertical data on Project Record Documents.

C. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, including private utilities, and other construction. If the location of known or suspected underground utilities cannot be verified, notify the Owner and Architect.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.2 PERFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale drawings to determine dimensions.

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. Upon completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and sitework.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION 012800

SECTION 012900 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 0 Section “Supplementary General Conditions” for requirements related to Payments and Completion.
2. Division 1 Section “Submittals” for the Contractor's Construction Schedule and the Submittal Schedule.
3. Division 1 Section “Unit Prices” for administrative requirements governing the use of unit prices.
4. Division 1 Section “Contract Modification Procedures” for administrative procedures for handling changes to the Contract.

C. Attachments: The following documents are attached to the end of this Section.

1. Partial Waiver and Release of Mechanics Lien Claims.
2. Initial Statement of Contract Value
3. Stipulation Against and Waiver of Liens.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's Construction Schedule.
b. Application for Payment forms, including Continuation Sheets.

c. List of subcontractors.
d. Schedule of alternates.
e. List of products.
f. List of principal suppliers and fabricators.
g. Schedule of submittals.

2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Application for Payment.
3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each specification section.

1. Identification: Include the following project identification on the Schedule of Values:

a. Project name and location.
b. Name of the Architect.
c. Project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related specification section and division.
b. Description of work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.

1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site (if permitted by Owner). Include requirements for insurance and bonded warehousing, if required.

6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.

1. Each Application for Payment MUST include an attached, executed Partial Waiver and Release of Mechanics Lien Claims Form.

a. The Contractor shall be responsible to have each subcontactor under their Contract.

B. Payment-Application Times: Draft applications for progress payments shall be presented to the Architect no later than the 25th of each month. The Architect will comment and return to the Contractor for final submission no later than the first of the following month. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.

D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

F. Initial Application for Payment: Administrative actions and/or submittals that must precede or coincide with submittal of the initial Application for Payment, include the following:

1. Execute an Initial Statement of Contract Value.
2. List of subcontractors.
3. List of principal suppliers and fabricators.

4. Schedule of Values.
5. Contractor's Construction Schedule (preliminary if not final).
6. Schedule of principal products.
7. List of Contractor's staff assignments.
8. Copies of building permits.

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
2. Administrative actions and/or submittals that shall precede or coincide with this application include:

    a. Occupancy permits and similar approvals.
    b. Warranties (guarantees) and maintenance agreements.
    c. Test/adjust/balance records.
    d. Maintenance instructions.
    e. Startup performance reports.
    f. Changeover information related to Owner's occupancy, use, operation, and maintenance.
    g. Final cleaning.
    h. Application for reduction of retainage and consent of surety.
    i. Advice on shifting insurance coverages.
    j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

H. Final Payment Application: Administrative actions and/or submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Execute a Contractor’s Affidavit of Release of Liens Form (AIA Document G706A).
2. Completion of Project closeout requirements.
3. Completion of items specified for completion after Substantial Completion.
4. Ensure that unsettled claims will be settled.
5. Ensure that incomplete Work is not accepted and will be completed without undue delay.
6. Transmittal of required Project construction records to the Owner.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks to Owner's access.

END OF SECTION 012900

SECTION 013100 – PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project.

B. The Contractor shall be responsible for coordination.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Field Engineering" specifies procedures for field-engineering services, including establishment of benchmarks and control pointsDivision 1 Section "Project Meetings" for progress meetings, coordination meetings, and preinstallation conferences.
3. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
4. Division 1 Section "Contract Closeout" for coordinating contract closeout procedures.
5. Division 4 Section “Unit Masonry Assemblies” for Masonry Preinstallation Shop Drawing requirements.
6. Division 21 through 28 Sections for specific coordination drawing requirements for mechanical and electrical installations.

1.3 GENERAL PROJECT COORDINATION PROCEDURES

A. The Contractor shall coordinate its construction activities with those of subcontractors and installers and other entities involved to assure efficient and orderly installation of each part of the Work. The Contractor shall coordinate its operations with operations included under different sections of the Specifications that depend on each other for proper installation, connection, and operation.

1. The Contractor shall schedule its construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Where availability of space is limited, the Contractor shall coordinate installation of different components with subcontractors and installers to assure maximum accessibility for required maintenance, service, and repair.

3. The Contractor shall make adequate provisions to accommodate items scheduled for later installation.

B. The Contractor shall advise the Owner and Architect of overall coordination progress. When necessary, such as in congested spaces, the Contractor shall meet with the Owner and Architect and subcontractors and installers involved to resolve critical coordination issues.

1.4 CONSERVATION

A. The Contractor shall coordinate construction activities to assure that operations are carried out with consideration given to conservation of energy, water and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into the Work.

1.5 COORDINATION DRAWINGS

A. Prepare coordination drawings where careful coordination is needed for installation of products and materials. Prepare coordination drawings where limited space availability necessitates efficient installation of different components.

B. Coordination drawings shall be completed **within 60 calendar days of the date of Notice to Proceed**. The Contractor shall include preparation of coordination drawings in their Contract Price and shall indicate the value of this effort as a line item on their Schedule of Values.

1. Refer to Division 21 through 28 Sections for specific coordination drawing requirements for mechanical and electrical installations.
2. The HVAC scope of work shall be used to initiate the coordination drawings. The Contractor shall produce ¼" scale drawings, by building section, in electronic format. Electronic media, in the format and to the terms specified in Paragraph 3.12 of Section 000750 Supplementary General Conditions, is available from the Architect. This media will include walls, partitions, structural elements, finished floor elevations, ductwork, piping, and equipment locations and layout. The coordination drawings shall include all other trades for inclusion, layout and interface of all relative equipment, material and penetrations associated with the Work
3. Upon resolution of all interference issues, the Contractor shall issue a set of final coordination drawings to all entities involved in the Work and to the Owner and Architect.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to its full-time on site Project Superintendent, the Contractor shall provide other administrative and supervisory personnel as required for proper performance of the Work. Include special personnel required for coordination.

B. Project Coordinator: The Contractor shall provide a Project Coordinator, experienced in administration and supervision of building construction, including mechanical and electrical work.

1. Construction activities requiring coordination by the Project Coordinator include, but are not limited to, the following:

a. Scheduling and sequencing of the Work
b. Cutting and patching
c. Selections for compatibility
d. Coordination drawings
e. Inspections and tests
f. Temporary services and facilities
g. Daily project clean up activities

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: The Contractor shall require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place during handling and installation. Apply protective covering where required to assure protection from damage or deterioration until Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: The Contractor shall supervise its construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Thermal shock
2. Excessively high or low humidity
3. Air contamination or pollution
4. Water or ice
5. Solvents

6. Chemicals
7. Light
8. Radiation
9. Puncture
10. Abrasion
11. Heavy traffic
12. Soiling, staining, and corrosion
13. Bacteria
14. Rodent and insect infestation
15. Combustion
16. Electrical current
17. High-speed operation
18. Improper lubrication
19. Unusual wear or other misuse
20. Contact between incompatible materials
21. Destructive testing
22. Misalignment
23. Excessive weathering
24. Unprotected storage
25. Improper shipping or handling
26. Theft
27. Vandalism

Any Work subjected to such exposures shall be tested, corrected and/or replaced at the expense of the Contractor, in accordance with Division 0 Section “General Conditions of the Contract for Construction”.

D. The Contractor shall provide daily project clean up of the work site.

END OF SECTION 013100

SECTION 013150 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Preconstruction conferences
2. Preinstallation conferences
3. Progress meetings
4. Coordination meetings

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Project Coordination" for procedures for coordinating project meetings with other construction activities.
2. Division 1 Section "Submittals" for submitting the Contractor's Construction Schedule.

1.3 PRECONSTRUCTION CONFERENCE

A. Within 15 calendar days of the date of Notice to Proceed, the Architect shall schedule and conduct a Preconstruction Conference at a time convenient to the Owner. Hold The Preconstruction Conference will be held at the Project Site or another convenient location. The purpose of this meeting will be to review the responsibilities and other requirements of the Contractor.

B. Attendees: Authorized representatives of the Owner, Architect and their consultants, the Contractor and its Superintendent, major subcontractors, manufacturers and suppliers. All participants at the Preconstruction Conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance including the following:

1. Construction schedule
2. Critical work sequencing
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment

6. Distribution of Contract Documents
7. Submittal of Shop Drawings, Product Data, and Samples
8. Preparation of record documents
9. Use of the premises
10. Parking availability
11. Office, work, and storage areas
12. Equipment deliveries and priorities
13. Safety procedures
14. First aid
15. Security
16. Daily clean up activities
17. Working hours

1.4 PREINSTALLATION CONFERENCES

A. The Contractor shall conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction and as required by specific specification Sections.

B. Attendees: The Installer and representatives of manufacturers and fabricators involved in, or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:

a. Contract Documents
b. Options
c. Related Change Orders
d. Purchases
e. Deliveries
f. Shop Drawings, Product Data, and quality-control samples
g. Review of mockups
h. Possible conflicts
i. Compatibility problems
j. Time schedules
k. Weather limitations
l. Manufacturer's recommendations
m. Warranty requirements
n. Compatibility of materials
o. Acceptability of substrates
p. Temporary facilities
q. Space and access limitations
r. Governing regulations
s. Safety

t. Inspecting and testing requirements
u. Required performance results
v. Recording requirements
w. Protection

2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute a record of the meeting to everyone concerned, including the Owner and the Architect.
3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

A. The Architect shall conduct progress meetings at the Project Site at bi-weekly intervals, unless otherwise needed.

B. Attendees: In addition to representatives of the Owner and the Architect, **it is mandatory that the General Contractor be represented at all Progress Meetings. Key subcontractors relevant to the ongoing Work shall also attend Progress Meetings.** All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

1. Contractor's Construction Schedule: Review construction progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
2. Review the present and future needs of each entity present, including the following:

a. Interface requirements
b. Time
c. Sequences
d. Status of submittals
e. Deliveries
f. Off-site fabrication problems
g. Access
h. Site utilization
i. Temporary facilities and services
j. Hours of work
k. Hazards and risks
l. Daily clean up activities
m. Quality and work standards
n. Change Orders
o. Documentation of information for payment requests

D. Reporting: Minutes will be distributed by the Architect at least 3 calendar days prior to the next meeting to each party present and to parties who should have been present.

1. Schedule Updating: Refer to Division 1 Section “Construction Progress Documentation” for requirements. Issue the revised schedule concurrently with the report of each meeting.

1.6 COORDINATION MEETINGS

A. The Contractor shall conduct coordination meetings a minimum of once every two weeks. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings. Record meeting minutes and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting. In addition, the Owner and Architect shall recieve copies of these meeting minutes.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013150

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Owner’s Preliminary Project Phasing Narrative
2. Contractor's Construction Schedule
3. Daily construction reports
4. Field condition reports
5. Special reports

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Project Coordination”
2. Division 1 Section "Applications for Payment" for submitting the Schedule of Values
3. Division 1 Section "Project Meetings" for submitting and distributing meeting and conference minutes
4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections
5. Division 1 Section "Project Record Documents" for submitting Project Record Documents at Project closeout
6. Division 1 Section “Submittals” for procedural requirements regarding the Submittal Schedule
7. Division 1 Section “Temporary Facilities & Controls” for the various stages of Construction relative to temporary heat which must be identified on the Contractor’s Construction Schedule.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish dates.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float is not for the exclusive use or benefit of either the Owner or the Contractor. Extensions of the time to interim milestone dates or the Contract Completion Date, under the Contract, will be granted only to the extent that equitable time adjustment to the activity or activities affected by the Contract Modification or delay, exceeds the total float of the affected or subsequent paths and extends any interim milestone date or the Contract Completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule showing activities and activity relationships.

1.4 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article and in-house scheduling personnel 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.

B. Preliminary Construction Schedule: Submit one (1) copy in an acceptable format as determined by the Architect.

C. Contractor’s Construction Schedule: Submit one (1) paper Gantt Chart and one (1) electronic copy in its native format.

D. CPM Reports: The Contractor's Construction Schedule shall be a CPM Schedule. Concurrent with the CPM Schedule, submit three (3) printed copies of each of the following computer-generated reports. The format for each activity in the reports shall contain an activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Daily Construction Reports: Submit two (2) copies at weekly intervals.

F. Field Condition Reports: Submit two (2) copies at time of discovery of differing conditions.

G. Special Reports: Submit two (2) copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Scheduling Professional Qualifications: The Contractor’s Construction Schedule shall be composed and maintained by an individual having been employed for at least five years primarily as a CPM scheduler or an individual certified as a Planning and Scheduling Professional (PSP) by the Association for the Advancement of Cost Engineering (AACE). Documentation supporting compliance with these requirements shall be supplied to the Architect for review and acceptance.

B. Prescheduling Conference: Conduct conference at the Project site to comply with requirements in Division 1 Section "Project Meetings". Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing, work stages, area separations and interim milestones.
2. Review delivery dates for Owner-furnished products.
3. Review time required for review of submittals and resubmittals.
4. Review requirements for tests and inspections by independent testing and inspecting agencies.
5. Review time required for completion and startup procedures.
6. Review and finalize the list of construction activities to be included in the schedule.
7. Review submittal requirements and procedures.
8. Review procedures for updating schedules.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities.

B. Coordinate the Contractor's Construction Schedule with the Schedule of Values, List of Subcontracts, Submittal Schedule, Progress Reports, Applications for Payment and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.7 OWNER'S PRELIMINARY PROJECT PHASING NARRATIVE

A. Except for the normal summer and holiday schedules, the Jersey Shore Elementary School will remain in operation and the building will remain open to the public in accordance with the following description of Phases. As a result, the Owner has proposed a detailed Phasing Plan. It is understood that this phasing plan is preliminary in nature and is not intended to represent all of the activities or possible sub-phases that may need to take place in order to complete construction within the Contract Time. The following is a description of the various phases and how they are interrelated:

Substantial Completion of each of the phases designated herein is considered Milestones to the overall Schedule and is subject to the provisions of Article 8 – "Time" of the General Conditions.

Total Project Duration: **519 Calendar Days**

1. Phase 1: Total Duration **440 Calendar Days (May 2019 – July 2020)**

Phase 1 – General: Phase 1 primarily consists of construction of the new four (4) level classroom wing, the administrative, guidance and health suites, the secure front entrance, expansion of the main commons, and the new auxiliary gymnasium and all related sitework not affected by subsequent or concurrent Phases may be completed during this Phase. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 1 construction shall commence at Notice to Proceed of the Contract. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the addition, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path.

2. Phase 2A: Total Duration **60 Calendar Days (May 2019 – July 2019)**

Phase 2A – General: Phase 2A primarily consists of construction work within the Auditorium B248 including selective demolition and installing the new door on the east elevation, replacement of the Masonite on the Stage B249, modification of the stage and installation of the accessible lift, and all framing. This work includes General and Electrical Construction.

a. Phase 2A construction shall commence at Notice to Proceed of the Contract. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

3. Phase 3A: Total Duration **60 Calendar Days (May 2019 – July 2019)**

Phase 3A – General: Phase 3A primarily consists of construction work within the Boys Locker Room D225 and Girls Lockers Room D213 including selective demolition and construction of rooms; Drying D218, Girls Team Room D219, Shower D220, Custodian Room D221 Toilet D222, Phys Ed Storage D224, Shower D226, Custodian D227, and Toilet D226. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 3A construction shall commence at Notice to Proceed of the Contract. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

4. Phase 4: Total Duration **187 Calendar Days (January 2020 – July 2020)**

Phase 4 – General: Phase 4 primarily consists of selective demolition of the existing Mechanical and Electrical rooms, one (1) Art classroom, Band Room. Selective Demolition of the Computer Classrooms after the building is unoccupied in May. Construction of Mechanical Room D206, a portion of Room D205 (Partial roof demolition in this area may be completed once the building is no longer occupied), Laundry D238, Toilet D239, Custodian D240, Freezer D241, CoolerD242, Serving D243, Kitchen D244, Office D245, Dishroom D246 and Kitchen D244. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 4 construction shall commence once the spaces are unoccupied on or around January 4, 2020. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

5. Phase 2B: Total Duration **60 Calendar Days (May 2020 – July 2020)**

Phase 2B – General: Phase 2B primarily consists of construction work within the Auditorium B248 including selective demolition and construction of HVAC, Lighting, Sprinkler System, Electrical power and low voltage, Interior Finishes, and Doors. All remaining Auditorium work is to be completed in this Phase. This work includes General, Mechanical, Fire Protection, and Electrical Construction.

a. Phase 2B construction shall commence once the building is unoccupied at the end of the school year. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

6. Phase 3B: Total Duration **60 Calendar Days (May 2020 – July 2020)**

Phase 3B – General: Phase 3B primarily consists of construction work within the Boys Locker Room D225 and Girls Lockers Room D213 including selective demolition and construction of rooms; Girls Locker Room D213, Passage D215, Office D216, Toilet D217, Toilet D230, Office D229, Passage D231, Storage D232, Storage D233 and any remaining space in the locker room area. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 3B construction shall commence once the building is unoccupied at the end of the school year. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

7. Phase 5: Total Duration **60 Calendar Days (May 2020 – July 2020)**

Phase 5 – General: Phase 5 primarily consists of selective demolition and construction work within the areas of the Boys and Girls Team Rooms, Trainer, Fitness Rooms and Prop Storage, Band and Choral Suites, Black Box Theater, and Main Commons. Site work not affected by Phase 6 may be completed during this Phase. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 5 construction shall commence once the building is unoccupied at the end of the school year. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

8. Phase 6: Total Duration **90 Calendar Days (July 2020 – September 2020)**

Phase 6 – General: Phase 2 primarily consists of selective demolition of portions of the mechanical and electrical rooms, demolition of two (2) – two (2) story classroom wings, sitework including bus drives, parking, loading dock and any remaining drives and parking areas. This work includes General, Mechanical. Plumbing, Fire Protection, and Electrical Construction.

a. Phase 6 construction shall commence once Phase 1 is substantially complete, the code official has provided the Owner with an occupancy certificate, and the Owner has moved out of the building to be demolished. If Phase 1 is completed early and the Owner and Architect approve, the Phase 6 may begin earlier than July 2020. The Contractor will be required to adhere to the Site Phasing plan at each phase of construction. Drawing PH.1 shows the limit of work area for each Phase. During the construction of the renovation, select demolition will be required. This work and occupied areas of the school must be separated with partitions as described in Section 015000 Temporary Facilities and Controls. During this phase the existing corridor ceilings, where required to perform work, may be removed and remain open until new ceilings are installed. All overhead utilities must be secured and lights installed a level. During construction of this Phase a protected egress path must be maintained from all occupied areas. This includes, but is not limited to: a framed scaffolding with protective side walls and protective ceiling through the construction area for safe egress path. All hazardous materials must be abated prior to start of construction work.

1.8 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. The Work under the Contract Documents shall be planned, scheduled, executed, reported and accomplished using the Critical Path Method, in work days (excluding legal holidays). The provisions of the General Requirements are to be followed in scheduling construction activities.

B. The primary objectives of the requirements of this Section are: (1) to insure adequate planning and execution of the Work by the Contractor by having a schedule of construction activities for the Contractor and Subcontractors in initial form covering the first 120 days of construction within thirty (30) days of the Notice to Proceed and in final form within seventy-five (75) days of the Notice to Proceed; (2) to assist the Contractor in evaluating progress of the Work; (3) to provide for optimum coordination by the Contractor of their trades and Subcontractors; and (4) to permit the timely prediction or detection of events or occurrences which may affect the timely prosecution of the Work.

C. The Contractor is responsible for determining the sequence and logic of activities, the time estimates of the detailed construction activities and the means, methods, techniques and procedures to be employed with regard to the Work. The Contractor's Construction Schedule shall represent the Contractor's best judgment of how they shall prosecute the Work in compliance with the requirements of the Contract Documents. The Contractor shall ensure that the Contractor's Construction Schedule is current and accurate and is properly and timely

monitored, updated and revised as Project conditions and the Contract Documents may require.

D. The Contractor shall consult with their major subcontractors relating to the preparation of their construction plan and the Contractor's Construction Schedule. Major subcontractors shall receive copies of those portions of the Contractor's Construction Schedule which relate to their Work and shall be continually advised of any updates or revisions to the Contractor's Construction Schedule as the Work progresses. When the Contractor submits their Construction Schedule or makes any proposed updates or revisions to such Schedule, it shall be concluded by the Owner that the Contractor has consulted with and has the concurrence of their major subcontractors. The Contractor shall be solely responsible for ensuring that all subcontractors comply with the requirements of the Contractor's Construction Schedule for their portions of the Work.

E. The Contractor shall include data relating to activities, durations and sequences as part of the Contractor's draft of the Construction Schedule. This data shall reflect the Contractor's actual construction plan for the Project, and shall fully comply with all requirements of the Contract Documents.

F. It is understood and agreed that the Contractor's Construction Schedule is to represent the Contractor's best plan and estimate for the Work; however, the Contractor acknowledges that the Contractor's Construction Schedule may have to be revised from time-to-time as the Project proceeds. The Contractor further acknowledges and agrees that the Owner does not guarantee that: (1) The Contractor can start Work activities on the "early start" or "late start" dates or complete Work activities on the "early finish" or "late finish" dates shown in the schedule, or as same may be updated or revised; or (2) The Contractor can proceed at all times in the sequence established by the Contractor's Construction Schedule, or that the Contractor can rely upon the utilization of only the resources and manpower they initially plan for the performance of the Work. Any changes, modifications or adjustments made by the Contractor to the Contractor's Construction Schedule shall be in full compliance with all requirements of the Contract Documents.

G. The Contractor acknowledges and agrees that their Contractor's Construction Schedule must be flexible in order to accommodate and allow for proper coordination.

H. The review of the Contractor's Construction Schedule or any other schedule or plan of construction of the Contractor, does not constitute an agreement by the Owner of any start or finish date in the schedule or specific durations or sequences for activities of the Contractor; further, nothing herein shall be construed as modifying or changing, or excusing the performance of the Contractor of required portions of the Work by the Completion Dates as set forth in the Contract Documents.

I. The Completion Dates set forth in the Contract Documents represent only the major items of Work and may or may not include interface dates with the construction activities of others. Completion Dates are Contract requirements and are the essence of the Contract Documents and to the coordination of the Work by the Contractor. Completion Dates represent the latest allowable completion time for those portions of the Work to which each Completion Date

relates. The Completion Dates are not intended to be a complete listing of all Work under the Contract Documents.

J. Unless otherwise specifically provided in the Contract Documents, and in particular the General Requirements, the Contractor acknowledges that the Owner and Architect have contemplated in their planning and in any preliminary schedule that may have been prepared and made available to the Bidders, and in their budgeting for professional services, that the Work shall be performed on a 5-day work week basis, utilizing a single 8-hour shift per day. The Owner shall have the sole discretion of approving or rejecting a variance in the work week, number of shifts, or shift length. Unless otherwise agreed to by the Owner, the Contractor shall bear the cost of, and pay the Owner, for additional staff and supervisory personnel and inspectors of any authority having jurisdiction of the Work, necessary to support any variance in the contemplated work week, number of shifts or shift length.

1.9 POST AWARD ACTIVITIES

A. Upon receipt by the Contractor of the Notice to Proceed, and until the Contractor's Construction Schedule is completed, the Contractor shall do the following.

1. Within thirty (30) days of the Notice to Proceed, complete an Preliminary Construction Schedule governing the first 120 days of construction.
2. Within seventy-five (75) days of the Notice to Proceed, complete a Final Construction Schedule governing the Work.

1.10 CONSTRUCTION SCHEDULE CONTENT

A. The Contractor's Construction Schedule shall consist of a detailed CPM Schedule of all Work activities of the Project. The Schedule shall include, but not be limited to, the following information: (1) Project name; (2) completed Work ready for use by the Owner, etc.; (3) activities relating to different areas of responsibility, such as subcontracted Work which is distinctly separate from that being done by the Contractor directly; (4) different categories of Work as distinguished by craft or crew requirements; (5) different categories of Work as distinguished by equipment requirements; (6) different categories of Work as distinguished by materials; (7) distinct and identifiable subdivisions of Work such as structural slabs, beams, columns; (8) location of Work within the Project that necessitates different times or crews to perform; (9) outage schedules for existing utility services that shall be interrupted during the performance of the Work; (10) acquisition and installation of equipment and materials supplied and/or installed by the Owner; (11) material to be stored on site; and (12) dates for completion of Work.

B. For all major equipment and materials to be fabricated or supplied for the Project, the Contractor's Construction Schedule shall show a sequence of activities including: (1) preparation of Shop Drawings, Samples and all required Submittals as set forth in these specifications; (2) a reasonable time for review of Shop Drawings, Samples, and Submittals or such time as specified in the Contract Documents; (3) shop fabrication, delivery, and storage; (4) erection or installation; and (5) testing of equipment and materials.

C. The Contractor's Construction Schedule shall clearly indicate the dates of the various stages of construction relative to temporary heat, as defined in Part 3 Paragraph "Temporary Heat" of Division 1 Section "Temporary Facilities & Controls".

D. The Gantt Chart shall include the early dates and total float for each activity. There shall be no negative float in the baseline schedule.

E. All activity durations shall be given in calendar days. No activity shall have a duration of more than twenty (20) days.

1.11 UPDATING OF CONSTRUCTION SCHEDULE/PROGRESS REPORTS

A. On a monthly basis the Contractor shall prepare the Contractor's report of actual progress. Said report shall set forth up-to-date and accurate progress data, shall be based upon the Contractor's best judgment and shall be prepared by the Contractor in consultation with all subcontractors.

B. The progress report of the Contractor shall show the activities, or portions of activities, completed during the reporting period, the actual start and finish dates for these activities, remaining durations and/or estimated dates for completion of Work for activities currently in progress.

C. The Contractor shall submit a written report with the updated progress analysis which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors and their impact, explanations of corrective actions taken or planned, any newly planned activities or changes in sequence, and proposed logic for a recovery schedule, if required, as further described herein. The report shall also include: (1) a narrative describing actual Work accomplished during the reporting period; (2) a list of major construction equipment used on the Project during the reporting period and any construction equipment idle during the reporting period; (3) the total number of personnel by craft actually engaged in the Work during the reporting period, with such total stated separately as to office, supervisory, and field personnel; (4) a manpower and equipment forecast for the succeeding thirty (30) days, stating such total as to office, supervisory and field personnel; (5) a list of Contractor-supplied materials and equipment, indicating current availability and anticipated job site delivery dates; and (6) changes or additions to the Contractor's supervisory personnel, if any, since the preceding progress report.

D. The Contractor understands and agrees that the submission and approval of progress updates and the receipt of progress reports are an integral part and basic element of the Applications for Payment; and that the Contractor shall not be entitled to any progress payment under the Contract Documents until, in the sole discretion of the Owner, the Contractor has fully complied with the requirements of this Section.

E. The Contractor shall be solely responsible for expediting the delivery of all materials and equipment to be furnished by or to them so that the progress of construction shall be maintained according to the currently approved Contractor's Construction Schedule for the Work. The Contractor shall notify the Owner in writing, and in a timely and reasonable manner,

whenever the Contractor determines or anticipates that the delivery date of any material or equipment to be furnished by the Contractor shall be later than the delivery date indicated by the Contractor's Construction Schedule, or required consistent with the completion requirements of the Contract Documents, subject to schedule updates as herein provided.

F. The Contractor shall ensure that off site activities do not control the critical path of the Contractor's Construction Schedule and instead, that the critical path only relates to activities on the site.

1.12 RECOVERY SCHEDULE.

A. Should the updated Contractor's Construction Schedule, at any time during the Contractor's performance, show, in the sole opinion of the Owner that the Contractor is fourteen (14) or more days behind schedule for any Completion Date, or should the Contractor be required to undertake actions as provided for in these specifications, the Contractor shall prepare a recovery schedule at no additional cost to the Owner (unless the Owner is solely responsible for the event or occurrence which has caused the schedule slippage) explaining and displaying how the Contractor intends to reschedule their Work in order to regain compliance with the Contractor's Construction Schedule during the immediate subsequent pay period.

B. If the Contractor believes that all of the time can be recovered during the subsequent pay period, the Contractor shall be permitted to prepare a recovery schedule as set forth below. However, if the Contractor believes it shall take more than thirty (30) days to recover all of the lost time, they shall prepare a revision to the Contractor's Construction Schedule and comply with all of the requirements of a schedule revision as set forth in this Paragraph 1.12 and Paragraph 1.13.

1. The Contractor shall prepare a limited duration recovery schedule, incorporating the best available information from Subcontractors and others which shall permit a return to the Construction Schedule at the earliest possible time. The Contractor shall prepare a recovery schedule to the same level of detail as the Construction Schedule for a maximum duration of one month.
2. Within two (2) days after submission by the Contractor of a recovery schedule, the Contractor shall participate in a conference with the Owner, to review and evaluate the recovery schedule. Within two (2) days of the conference, the Contractor shall submit the revisions necessitated by the review for the Owner's review and approval. The Contractor shall use the approved recovery schedule as their plan for returning to the Contractor's Construction Schedule.
3. The Contractor shall confer continuously with the Owner to assess the effectiveness of the recovery schedule. As a result of this conference:

    a. If the Owner determines the Contractor is still behind schedule, the Owner shall direct the Contractor to prepare a schedule revision and comply with all of the requirements of a schedule revision as stated herein and the other requirements of the Contract Documents; provided, however, that nothing herein shall limit in any way the rights and remedies of the Owner as provided elsewhere in the Contract Documents; or

b. If the Owner determines the Contractor has successfully complied with the provisions of the recovery schedule, the Owner shall direct the Contractor to return to the use of the approved Contractor's Construction Schedule.

1.13 SCHEDULE REVISIONS

A. Should the Contractor desire to or be otherwise required under the Contract Documents to make modifications or changes in their method of operation, their sequence of Work or the durations of the activities in the Contractor's Construction Schedule, they shall do so in accordance with the requirements of this Paragraph and the Contract Documents. Revisions to the approved Contractor's Construction Schedule must be presented to and reviewed by the Owner.

B. The Contractor shall submit requests for revisions to the Contractor's Construction Schedule to the Owner, together with written rationale for revisions and description of logic for rescheduling Work and maintaining the Completion Dates listed in the Contract Documents. Proposed revisions acceptable shall be incorporated into the next update of the Contractor's Construction Schedule. The Contractor shall pay the Owner for costs incurred by the Lead Contractor for the revisions.

C. In all instances where a revision to the Contractor's Construction Schedule will affect the construction activities of other Prime Contractors, prior to submission by the Contractor of their proposed schedule revisions, they shall meet with and gain written approval of each of the Prime Contractors to make the revisions which shall be evidenced by the signatures of said Prime Contractors on the proposed schedule revisions. If accepted, the revisions, shall be binding upon the Contractor and all Prime Contractors on the Project.

1.14 FLOAT TIME

A. Float or slack time associated with one chain of activities is defined as the amount of time between the earliest start date and latest start date or between the earliest finish date and latest finish date for such activities, as calculated as part of the Contractor's Construction Schedule. The Contractor agrees that there shall be no basis for any modification of the Completion Date or dates or an extension of the Contract Time, or a claim for additional compensation as a result of any Project problem, Change Order or delay which only results in the loss of available positive float on the Contractor's Construction Schedule.

1.15 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule within 10 days of the date established for commencement of the Work.

B. The schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number

2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples.
9. Unique characteristics of each service

C. Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

1.16 REPORTS

A. Daily Construction Reports: Prepare Daily Construction Reports recording the following information concerning events at the Project site:

1. List of subcontractors at Project site
2. Approximate count of personnel at Project site
3. High and low temperatures and general weather conditions
4. Accidents
5. Meetings and significant decisions
6. Unusual events (refer to special reports)
7. Stoppages, delays, shortages, and losses
8. Meter readings and similar recordings
9. Emergency procedures
10. Orders and requests of authorities having jurisdiction
11. Change Orders received and implemented
12. Construction Change Directives received
13. Services connected and disconnected
14. Equipment or system tests and startups
15. Partial Completions and occupancies
16. Substantial Completions authorized

B. Field Correction Reports: When the need to take corrective action that requires a departure from the Contract Documents arises, prepare a detailed report. Include a statement describing the problem and recommended changes. Indicate reasons the Contract Documents cannot be followed. Submit a copy to the Architect immediately.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Material Location Reports: At weekly intervals, prepare a comprehensive list of materials delivered to and stored at the site. The list shall be cumulative, showing materials previously reported plus items recently delivered. Include with the list a statement of progress on and

delivery dates for materials or items of equipment fabricated or stored away from the site. Submit copies of the list to the Architect at weekly intervals.

1.17 SPECIAL REPORTS

A. General: Submit Special Reports directly to the Owner within one day of an occurrence. Distribute copies of reports to parties affected by the occurrence and to the Architect.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at the Project site, whether or not related directly to the Work, prepare and submit a Special Report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise the Owner in advance when these events are known or predictable.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013200

SECTION 013300 - SUBMITTALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Submittals required for performance of the Work, including the following:

1. Shop Drawings
2. Product Data
3. Samples
4. Quality Assurance Submittals
5. Submittals Schedule

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits
2. Applications for Payment, along with Initial Statement of Contract Value
3. Performance and Payment Bonds
4. Insurance certificates
5. List of subcontractors

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section “Substitutions” specifies procedural requirements for handling requests for substitutions made after award of the Contract.
3. Division 1 Section “Project Coordination” specifies requirements governing preparation and submittal of required Coordination Drawings.
4. Division 1 Section “Project Meetings” specifies requirements for submittal and distribution of meeting and conference minutes.
5. Division 1 Section “Construction Progress Documentation” specifies requirements for Submittal Schedules.
6. Division 1 Section “Quality Requirements” specifies requirements for submittal of inspection and test reports.
7. Division 1 Section “Warranties” specifies requirements for Submittal of warranties at project closeout.

8. Division 1 Section “Project Record Documents” specifies requirements for submittal of Project Record Documents at project closeout.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section “Project Coordination” and may include components previously shown in detail on Submittals.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

D. For Specification sections listing manufacturer’s products that include the phrases “but are not limited to the following” or “approved equal”, the Contractor shall be responsible to provide certification that the submitted product complies with the specified product. Include this certification with the Submittal. Final approval of a product submitted as an “equal” shall be solely by the Architect.

1.4 SUBMITTAL PROCEDURES

A. **All Submittals shall be processed electronically through a web-based construction administration software, either Newforma or Submittal Exchange, to be determined by the Architect**. This software serves as a collaborative web environment which expedites and organizes the review process. The Owner will pay the fees associated to aquire the use of a license for the project. **Each Submittal is to include a SINGLE item or element of construction only. A Submittal Cover Sheet, on the attached form shall be completed, signed and certified by the Contractor for EACH Submittal. The Architect will not accept Submittals including multiple items or elements of construction. Submittals not meeting this procedure requirement may be returned with No Action Taken. No extension of Contract Time will be authorized due to failure to comply with this procedure.**

1. The software licensee will provide a training session via web conference for the construction team.
2. All samples and color selections shall be delivered by mail or courier. Samples shall be logged in via the construction administration software, but delivered hardcopy by mail.
3. The design and construction team shall collectively maintain the Submittal Log through the construction administration software.

B. Coordination: Coordinate preparation and processing of Submittals with performance of construction activities. Transmit each Submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each Submittal with fabrication, purchasing, testing, delivery, other Submittals and related activities that require sequential activity.
2. Coordinate transmittal of different types of Submittals for related elements of the Work so processing will not be delayed by the need to review Submittals concurrently for coordination.

    a. The Architect reserves the right to withhold action on a Submittal requiring coordination with other Submittals until all related Submittals are received.
    b. Be advised that all interior finishes will be reviewed together and finally determined after receipt of all shop drawings, product data and samples which pertain to the interior finish color selections and related equipment.

3. To avoid the need to delay installation as a result of the time required to process Submittals, allow sufficient time for Submittal review, including time for resubmittals.

    a. Allow a minimum of fifteen (15) working days for review. Additional time may be required for further review and/or coordination with consultants and subsequent Submittals as determined by the Architect.
    b. If a resubmittal is necessary, process the same as the original Submittal.
    c. No extension of Contract Time will be authorized because of failure to transmit Submittals to the Architect sufficiently in advance of the Work to permit processing.

C. Submittal Preparation: The Architect will not accept Submittals received without the attached 'Submittal Cover Sheet'. The Contractor shall stamp the 'Submittal Cover Sheet' with an action stamp. The Contractor shall mark the stamp appropriately to indicate the action taken. **Submittals shall be pre-reviewed by the Contractor PRIOR to submittal to the Architect for review.** See Paragraph 1.6.C.1 of this Section for additional information.

1. Use the 'Submittal Cover Sheet' attached at the end of this Section for all Submittals.
2. Complete all information required on the 'Submittal Cover Sheet'. Failure to do so may result in return of the Submittal with No Action Taken. No extension of Contract Time will be authorized because of failure to comply with this procedure.

D. Contractor's Transmittal: The Architect will not accept Submittals received from sources other than the Contractor.

1.5 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit three copies of the Submittal Schedule to the Architect. Arrange the following information in a tabular format:

1. Scheduled date for first Submittal
2. Specification Section number and title

3. Submittal category (action or informational)
4. Name of Subcontractor
5. Description of the Work covered
6. Scheduled date for final release or approval

B. Submit the Submittal Schedule, arranged in chronological order by dates required by the Contractor's Construction Schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication and delivery when establishing dates.

1. Coordinate the Submittal Schedule with the List of Subcontractors, the Schedule of Values and Contractor's Construction Schedule.
2. Initial Submittal: Submit an Initial Submittal Schedule concurrently with the Initial Construction Schedule. Include Submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture, fabrication or delivery.
3. Final Submittal: Submit a Final Submittal Schedule concurrently with the Final Contractor's Construction Schedule. Include all remaining Submittals. All Submittals are required to be submitted by the Contractor within ninety (90) days of the date of Notice to Proceed.

C. Distribution: Following response to the initial Submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTALS

A. Shop Drawings:

1. Submit newly prepared information drawn accurately and to scale. Highlight, circle or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
2. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

    a. Dimensions
    b. Identification of products and materials included by sheet and detail number
    c. Notation of dimensions established by field measurement

d. Submit Shop Drawings electronically through the construction administration software for the Architect's review.
e. The Architect will return Submittals electronically and indicate action taken.
f. Maintain a complete set of Shop Drawings on site during construction.
g. Maintain a set of marked up Shop Drawings as part of the project record documents to be turned over to the Owner at Contract Closeout.
h. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

B. Product data

1. Collect and assemble Product Data into a single Submittal for each element or system of construction. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves.
2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on product options that are not required or are not being used, mark Product Data to indicate the applicable products and information. Include the following information:

a. Manufacturer's printed recommendations
b. Compliance with trade association standards
c. Compliance with recognized testing agency standards
d. Application of testing agency labels and seals
e. Notation of dimensions verified by field measurement
f. Notation of coordination requirements
g. Submit Product Data electronically through the construction administration software for the Architect's review.
h. The Architect will return Product Data electronically and indicate action taken.
i. Maintain a complete set of Product Data on site during construction.
j. Maintain a set of marked up Product Data as part of the project record documents to be turned over to Owner at Contract Closeout.
k. Do not use Product Data without an appropriate final stamp indicating action taken.

C. Action Stamp: **The Contractor will thoroughly review and stamp Submittals** with their action stamp. The Contractor shall mark the stamp appropriately to indicate the action taken.

1. Contractor's review notations and action stamp shall be applied with **GREEN** color ink

D. Distribution: Furnish final approved Submittals to installers, subcontractors, suppliers, manufacturers, fabricators, and all others required for performance of construction activities.

1.7 SAMPLES

A. Where required by individual specification sections, submit full-size, fully fabricated Samples cured and finished as specified and physically identical to the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, physical material samples, color range sets or swatches showing color, texture, and pattern.

1. Mount or display Samples in a manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample or in accordance with the product specifications. Include the following:

    a. Specification Section number and reference
    b. Generic description of the Sample
    c. Sample source
    d. Product name or name of the manufacturer
    e. Compliance with recognized standards
    f. Availability and delivery time

2. Submit Samples for review of size, kind, color, pattern and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final Submittal and the actual component as delivered and installed.

    a. Where variation in color, pattern, texture or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    c. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Submit a full set of choices where Samples are submitted for selection of color, pattern, texture or similar characteristics from a range of choices as specifed.
4. The Architect will review and return preliminary Submittals with the Architect's notation, indicating selection and other action.

1.8 QUALITY ASSURANCE SUBMITTALS

A. Submit Quality Control Submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports and other quality control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material or installation complies with specified requirements, submit a certification from the manufacturer certifying compliance with the specified requirements. The Architect reserves the right to require this certification to be notorized.

1. The Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Requirements."

1.9 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each Submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each Submittal with a uniform action stamp. The Architect's review notations and action stamp shall be applied with **RED** color ink. The Architect will mark the stamp to indicate the action taken, as follows:

1. NO EXCEPTION TAKEN: The Work covered by the Submittal may proceed without further submittal, provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. EXCEPTION(S) NOTED: The Work covered by the Submittal may proceed provided it complies with notations or corrections on the Submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. SUBMIT SPECIFIED: Do not proceed with Work covered by the Submittal, including purchasing, fabrication, delivery or other activity. Prepare a new Submittal indicating specified material; resubmit without delay.
4. REVISE & RESUBMIT: Do not proceed with Work covered by the Submittal, including purchasing, fabrication, delivery or other activity. Revise or prepare a new Submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
5. REJECTED: Do not proceed with Work covered by the Submittal, including purchasing, fabrication, delivery or other activity. Do not resubmit a revised copy; prepare a new Submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

C. Unsolicited Submittals: The Architect will take no action on unsolicited submittals.

END OF SECTION 013300

SUBMITTAL COVER SHEET
(Attach to each copy of each submittal)

PROJECT NAME & NUMBER _____

ARCHITECT: **Crabtree, Rohrbaugh & Associates Architects**
250 West Main Street, Suite 200
Charlottesville, Virginia 22902
Phone: (866) 458-0272

_____

ENGINEER: _____

CONTRACTOR: _____

SUBCONTRACTOR/SUPPLIER: _____

MANUFACTURER: _____

ITEM SUBMITTED: _____ SUBMITTAL NO. _____

SPECIFICATION SECTION NO. _____ PARAGRAPH NO. _____

DRAWING REFERENCE _____ DETAIL NO. _____

CERTIFICATION: (Circle One)

A. Certified to comply with Drawings and Specifications.

B. Certified to comply with Drawings and Specifications except as noted on Contractor attachment(s)

Signature: Subcontractor/Supplier Date Signature: Contractor Date

Contractor's Action Stamp Here

Architect's Action Stamp Here

SUBMITTAL DEVIATION SHEET
(Attach this sheet behind Submittal Cover Sheet)

PROJECT NAME AND NUMBER: _____

ARCHITECT: 

Crabtree, Rohrbaugh & Associates Architects
250 West Main Street, Suite 200
Charlottesville, Virginia 22902
Phone: (866) 458-0272

_____

ENGINEER: _____

CONTRACTOR: _____

SUBCONTRACTOR/SUPPLIER: _____

PRODUCT SPECIFIED: _____

SPECIFICATION SECTION NO. _____ PARAGRAPH NO. _____

DRAWING REFERENCE _____ DETAIL NO. _____

DESCRIPTION OF DEVIATION: _____

_____

_____

_____

_____

_____

_____

_____

Signature: Subcontractor/Supplier Date Signature: Contractor Date

ARCHITECT/ENGINEER REMARKS:

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Document.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit the Contractor's quality-control procedures that facilitate compliance with the requirements of the Contract Document.
3. Requirements for the Contractor to provide quality-control services required by the Architect, Owner or authorities having jurisdiction are not limited by the provisions of this Section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections
2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities
3. Divisions 2 through 33 Sections for specific test and inspection requirements

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions and procedures performed before and during execution of the Work to guard against defects and deficiencies and to ensure that proposed construction complies with Project requirements.

B. Quality-Control Services: Tests, inspections, procedures and related actions during and after execution of the Work to evaluate that completed construction complies with Project

requirements. Services do not include contract enforcement activities performed by the Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation. Samples are not mockups.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of the Contractor by the Contract Documents, provide products and systems complying with the specific performance and design criteria indicated.

1. If the criteria indicated is not sufficient to perform the services or certifications required, submit a written request for additional information to the Architect.

1.5 REGULATORY REQUIREMENTS

A. Copies of Regulations: Obtain copies of applicable regulations and retain at the Project site to be available for reference by parties who have a reasonable need.

1.6 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with the performance and design criteria indicated. Include a list of codes, loads and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title
2. Description of test and inspection
3. Identification of applicable standards
4. Identification of test and inspection methods
5. Number of tests and inspections required

6. Time schedule or time span for tests and inspections
7. Entity responsible for performing tests and inspections
8. Requirements for obtaining samples
9. Unique characteristics of each quality-control service

D. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue
2. Project title and number
3. Name, address, and telephone number of testing agency
4. Dates and locations of samples and tests or inspections
5. Names of individuals making tests and inspections
6. Description of the Work and test and inspection method
7. Identification of product and Specification Section
8. Complete test or inspection data
9. Test and inspection results and an interpretation of test results
10. Ambient conditions at the time of sample taking and testing and inspecting
11. Comments or professional opinion on whether tested or inspected Work complies with the requirements of the Contract Documents
12. Name and signature of laboratory inspector
13. Recommendations on retesting and re-inspecting

E. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by the manufacturer to inspect the installation of the manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is qualified and legally licensed to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those

performed for installations of the system, assembly or product that are similar to those indicated for this Project in material, design and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy the qualification requirements indicated and shall be engaged for the activities indicated.

1. The requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct the testing and inspecting indicated, as documented by ASTM E 548, and that specializes in the types of tests and inspections to be performed.

H. Preconstruction Testing: A qualified testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:

a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of the product to comply with performance requirements.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Fabricate and install test assemblies using installers who will perform the same tasks for this Project.
d. When testing is complete, remove assemblies; do not reuse materials on the Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to the Architect, with copy to the Contractor. Interpret tests and inspections and state in each report whether the tested and inspected work complies with or deviates from the requirements of the Contract Documents.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by the Architect.
2. Notify the Architect at least seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain the Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as the Owner's responsibility, the Owner will engage a qualified testing agency to perform these services.

1. The Owner will furnish the Contractor with the names, addresses and telephone numbers of the testing agencies engaged and a description of the types of testing and inspecting each is engaged to perform.
2. The Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the requirements of the Contract Documents will be charged to the Contractor.

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as the Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. The Contractor shall not employ the same entity engaged by the Owner, unless agreed to in writing by the Owner.

2. Notify testing agencies at least 24 hours in advance of the time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as the Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by the Contractor, which are not required by the Contract Documents, are the Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Special Tests and Inspections: The Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of the Owner.

1. Testing agency will notify the Architect and the Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection and similar quality-control service to the Architect, with copy to the Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the requirements of the Contract Documents.
5. Testing agency will retest and reinspect corrected work. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the requirements of the Contract Documents will be charged to the Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were the Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with the requirements established by the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with the Architect and the Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection and similar quality-control service through the Contractor.
4. Do not release, revoke, alter or increase the requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of the Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work
2. Incidental labor and facilities necessary to facilitate tests and inspections
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples
4. Facilities for storage and field-curing of test samples
5. Delivery of samples to testing agencies
6. Preliminary design mix proposed for use for material mixes that require control by the testing agency.
7. Security and protection for samples and for testing and inspecting equipment at the Project site.

H. Coordination: Coordinate the sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid the necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit the schedule within 30 days of the date established for the Notice to Proceed.

1. Distribution: Distribute the schedule to the Owner, the Architect, the testing agencies and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with the installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014100 – SAFETY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: This Section specifies the required safety procedures for this Project.

B. It is recognized that the safety of all personnel is the responsibility of the Contractor. It is the contractual obligation of the Contractor to adhere to all requirements of the Occupational Health and Safety Act (OSHA), as well as Local and State safety rules and regulations. The Contractor shall assure the safety of their personnel by providing all protection and safety devices, covers, etc. as they relate to the safe conduct of their work in accordance with all Local, State and Federal regulations

C. Responsibilities of the Contractor shall be as follows:

1. Inspect and maintain safe working conditions on the jobsite.
2. Maintain a competent person on site at all times designated to make safety inspections and to serve as the designated representative in charge of safety during an inspection by OSHA.
3. The Contractor's responsibilities and corresponding authority is as defined in the General Conditions of the Contract for Construction.
4. Provide regular and periodic safety inspections and reports by an independent safety consultant. Inspections and reports shall be performed at least once every three months.
5. Provide a safety representative who is trained in First Aid and CPR.
6. Separation of students and faculty from workers will be required to the greatest extent possible.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 ACCIDENTS

A. The Contractor shall notify the Owner of any personal injury at the project site that could require medical treatment. Also, any damage to property arising in connection with the Contractor's performance should be brought to the attention of the Owner as promptly as possible after the occurrence of such injury or damage, but no more than 24 hours after the

occurrence. Within 48 hours of such occurrence, the Contractor shall furnish to the Owner a complete written report of such injury or damage. Accident Reports shall include specific actions taken by the Contractor to preclude recurrence of similar incidents.

3.2 EMERGENCY DATA

A. The Contractor shall provide the Owner with the following emergency data prior to beginning work at the project site:

1. Emergency care facility to be utilized, including address and telephone number
2. Insurance company and local agent/name, address and telephone number
3. Detailed description of corporation or company safety program
4. Employees qualified in type of first aid; list employee and associated skills
5. Detailed description of specifically tailored job site safety program
6. Identify corporate and job site safety officer
7. Submit weekly TOOL BOX SAFETY TALK program/meeting minutes including:

    a. Day of week
    b. Time of day
    c. Location
    d. Attendance record
    e. Agenda
    f. Unsafe items previously discussed and date of correction
    g. Identify on-site personnel with First Aid training

8. All applicable MSDS Program sheets. (Include numbered pages and Table of Contents)
9. Submit completed hazardous substance survey form
10. Review project “Emergency Response Plan” with the Owner

3.3 SAFETY AGREEMENT

A. The Contractor shall review and comply with the following Safety Agreement before beginning work:

1. As the Contractor under this Contract, you have, by accepting this Contract, obligated yourself to conduct all your operations within this Safety Agreement.
2. The Contractor agrees that the prevention of accidents to employees engaged in the Work under this Agreement is the responsibility of the Contractor.
3. The Contractor agrees to comply with all laws, regulations and codes concerning safety as shall be applicable to the Work and to the safety standards established during the progress of the Work. When so ordered, the Contractor agrees to stop any part of the Work which any applicable agency may deem unsafe, until corrective measures satisfactory to the Owner and in accordance with the applicable Federal and/or State regulations have been taken and further agrees to make no claim for damages growing out of such stoppages. Should the Contractor neglect to adopt such corrective measures, the Owner may elect to hire an entity, perform the corrections and deduct the cost from

payments due or to become due the Contractor. Failure on the part of the Owner to stop unsafe practices shall in no way relieve the Contractor of their responsibility.

4. The Contractor realizes that an effective accident prevention program is to the mutual benefit the Contractor through improved employee and public relations and through increased efficiency and production.
5. Your attention is directed, but not limited to the following items:

3.4 HOUSEKEEPING

A. Indiscriminate accumulations of debris, waste or scrap in work areas will not be permitted. (Areas will be designated for storage or disposal). All materials, tools and equipment must be stored in an orderly manner in designated areas.

3.5 PERSONAL PROTECTION EQUIPMENT

A. Contractors must furnish their employees with the proper type of personal protective equipment as required by the operations being performed, including, but not necessarily limited to the following:

1. Hard Hats must be furnished to employees and worn at ALL times when on the project, whether or not an overhead hazard exists or what state of construction the project may be in.
2. The Owner requires that appropriate attire be worn at all times while employees are working on-site. Appropriate attire shall be as deemed necessary by the Owner and in accordance with all applicable OSHA regulations.

3.6 SAFETY MEETINGS

A. The Contractor is required to conduct, and all employees are required to attend Tool Box type safety meetings once a week. The meetings may be presided over by either the Contractor's foreman or another competent representative designated by the Contractor.

3.7 FIRE PROTECTION

A. The Contractor must supply approved fire extinguishers for emergency use within his own immediate area of operation, including the Contractor's office, tool and storage enclosures.

3.8 TREATMENT OF INJURIES

A. The Contractor shall require that all employees injured (no matter how slight) while working on the project, report immediately for First Aid treatment. The Contractor shall maintain adequate First Aid facilities in the field.

3.9 COOPERATION

A. Any deviation from this course of action will be called to the attention of the Contractor for immediate correction.

3.10 INSTALLED SAFETY APPARATUS

A. The Contractor is responsible for the installation of any safety apparatus required to perform the work of this project.

3.11 WEAPONS POLICY

A. All persons are prohibited from carrying, possessing or storing a handgun, firearm, or weapon of any kind while on the Project site, regardless of whether the person has registered the weapon or is licensed to carry a concealed weapon. Failure to abide by all terms and conditions of this policy may result in discipline up to and including termination. Further, carrying any weapon onto the Owner's property in violation of this policy will be considered an act of criminal trespass and possession of a weapon will be grounds for immediate removal of the person from the Project site, and may result in prosecution.

3.12 LISTENING DEVICES

A. The playing of radios or any other type of personal listening devices, using any type of speaker, including, but not limited to, headphones and ear buds, will not be permitted on this Project.

3.13 TOBACCO PRODUCTS

A. Smoking or the use of any tobacco products and vapor pens included on any school district-owned property is a violation of both District policy and state law. Violators caught smoking or using tobacco products will be removed from the Project and prosecuted to the fullest extent of the law.

3.14 DRUGS AND ALCOHOL

A. Any personnel caught possessing or using/consuming illegal drugs or alcoholic beverages on any part of school district-owned property will be removed from the Project and will be prosecuted to the fullest extent of the law.

END OF SECTION 014100

SECTION 015000 - TEMPORARY FACILITIES & CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Temporary water service and distribution
2. Temporary electrical power service and light
3. Storm facilities and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Temporary roads and paving
3. Dewatering facilities
4. Temporary enclosures
5. Hoists
6. Temporary project identification signs and bulletin boards
7. Waste disposal services
8. Rodent and pest control
9. Construction aids and miscellaneous services and facilities
10. Temporary heat
11. Ventilation
12. Sanitary facilities, including drinking water

D. Security and protection facilities include, but are not limited to, the following:

1. Temporary Fire Protection
2. Barricades, warning signs, and lights
3. Enclosure fencing for the site
4. Environmental protection

1.3 RESPONSIBILITIES

A. The Contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility, as well as the costs and use charges associated with each facility unless noted otherwise.
2. Temporary electric power service and distribution. Prior to temporary utility availability, provide trucked in service.
3. Temporary lighting.
4. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting.
5. Multi-phase power service or power requirements in excess of 120-V, single phase, temporary power. Electric service for welding.
6. Temporary enclosure of the building.
7. Temporary heat, ventilation, humidity control.
8. Temporary toilets, including disposable supplies.
9. Containerized bottled-water drinking-water units.
10. Temporary water service. Prior to temporary utility availability, provide trucked in service.
11. Dewatering, including ice and snow removal of the building pad and in areas of foundation excavation and for all general construction activities. Dewatering and ice/snow removal must be completed no less than 24 hours (next business day) of the weather event.
12. Temporary roads and paving required to complete construction activities.
13. All hoisting requirements for construction activities
14. Continuous removal and disposal of general construction waste and debris generated by construction activities.
15. Collection and proper disposal of hazardous, dangerous, unsanitary or other harmful waste material.
16. Secure enclosure and lockup.
17. Secure lockup of tools, materials and equipment.
18. Construction aids and miscellaneous services and facilities.
19. Job trailer or field office.
20. A field office for the Owner's Clerk-of-the-Works.
21. Storage and fabrication sheds or trailers.
22. Temporary safety facilities.
23. Temporary construction identification signs and temporary site directional signage.
24. Rodent and pest control.
25. Barricades, warning signs and lights for construction activities.
26. Enclosure fence as required by construction activities. Refer to site drawings for extent. Environmental protection for construction activities.
27. Temporary stairway construction.
28. **Completion of installation of the permanent heating systems for use as temporary heat** and air conditioning, a minimum of 120 days prior to the date of Substantial Completion for each area of the building or phase of construction.
29. Operation and maintenance of the permanent HVAC systems when used for temporary heat and air conditioning after enclosure of the building, beginning 120 days prior to the date of Substantial Completion for each area of the building or phase of construction.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or

Architect unless specifically noted otherwise. The Owner will not accept the Contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.

B. Water Service: The Owner will pay water service use charges, for all metered water used by all entities engaged in construction activities at the Project Site.

C. Water Service within Renovation Areas: Temporary water services within the existing building area to be renovated may be developed from existing building utilities approved by the Owner. Water service use charges for incidental use in renovation areas will be paid for by the Owner if they are developed from sources currently metered by the Owner. Such services may be developed only if adequate service is available without disruption to existing facility operations and must be limited to work directly associated with renovation of the existing facility.

D. Electric Power Service: The Owner will pay electric power service use charges, for all metered electric power used by all entities engaged in construction activities at the Project Site. The Owner's electric service is not permitted to be used for temporary heat.

E. Electric Power Service within Renovation Areas: Incidental electrical power use in renovation areas may be developed from existing facilities at locations approved by the Owner. Electric power service use charges for incidental use in renovation areas will be paid for by the Owner if they are developed from sources currently metered by the Owner. Incidental power usage shall be defined as temporary lighting and temporary power for small tools, (120v). Existing power sources may not be utilized for temporary heat, welding, or other high voltage power requirements.

F. Fuel for Temporary Heat: As described in the Temporary Heat paragraph.

1.5 SUBMITTALS

A. Temporary Utilities: The Contractor shall submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of the date established for submittal of the Contractor's Construction Schedule, the Contractor shall submit a schedule indicating implementation and termination dates of each temporary utility for which the Contractor is responsible.

1.6 QUALITY ASSURANCE

A. Regulations: The Contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department and rescue squad rules

5. Environmental protection regulations

B. Standards: The Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities".

1. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Utilities: The Contractor shall prepare a schedule indicating dates for implementation and termination of each temporary utility for which the Contractor is responsible. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary services to use of permanent services.

1. Temporary Use of Permanent Facilities: The Contractor shall assume responsibility for its operation, maintenance and protection during use as a construction facility prior to the Owner's acceptance, regardless of previously assigned responsibilities. The Contractor shall make permanent facilities available in accordance with the approved Contractor's Construction Schedule.
2. Warranty Period: The Warranty Period for the entire project shall begin on the date of Substantial Completion, regardless of the start-up date for use as a temporary or permanent facility, including but not limited to materials and equipment.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on-site.

1.8 EXISTING BUILDING SYSTEMS

A. The Contractor, in submitting a bid, certifies that they have familiarized themselves with all existing building conditions and systems encountered. The Contractor shall protect and maintain all existing building systems, functions and utilities during the construction period or until new Work replaces the aforementioned.

B. System Interruption: If there is a need to interrupt any existing building function, utility or system for an extended period of time, the Contractor must coordinate this with the Owner and provide temporary provisions in advance to replace the interrupted function, utility or system.

C. Existing Systems, Functions and Utilities: The following is a partial list, which is not all inclusive, of the existing Systems, Functions and Utilities:

1. Existing electrical service, including all associated systems and functions
2. Existing water service, domestic and hot water systems
3. Sanitary and storm water systems
4. Existing HVAC systems, boilers and units
5. Existing BAS and/or ATC systems
6. Existing compressed air systems
7. Existing lighting systems
8. Existing data and communications systems
9. Existing structural systems
10. Existing fire alarm systems
11. Existing fire sprinkler systems
12. Existing building security systems

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: The Contractor shall provide new materials. If acceptable to the Owner or Architect, undamaged, previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Lumber and Plywood: Comply with the requirements of Division 6 Section "Rough Carpentry".

1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
2. For signs and directory boards, provide exterior-type, Grade BB, high-density concrete form grade overlay plywood of sizes and thicknesses indicated.

C. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

D. Water: Provide potable water approved by local health authorities.

E. Open-Mesh Fencing (Driven Posts on grass areas): Provide 0.12-inch thick, galvanized 2-inch chain-link fabric fencing 6 feet high with galvanized steel pipe posts, 1-1/2 inches I.D. for line posts and 2-1/2 inches I.D. for corner posts.

F. Open-Mesh Fencing (Portable on asphalt): Provide 0.12-inch thick, galvanized 2-inch chain-link fabric fencing 6 feet high on portable frames with self-standing T-foot posts

2.2 EQUIPMENT

A. General: The Contractor shall provide new equipment. If acceptable to the Owner or Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for the use intended.

B. Water Hoses: Provide 3/4-inch heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at point of hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher voltage outlets. Provide 120-V, single phase, ground-fault outlets at 100' on center in corridor areas and spaces larger than 800 square feet. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service lamps of wattage required for adequate illumination. At a minimum, install weatherproof sockets complete with lamps at 20' on center in all corridor areas, circulation areas and all spaces over 400 square feet. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: The Contractor shall provide its own prefabricated or mobile units with lockable entrances, operable windows and serviceable finishes.

1. The Contractor, if their temporary office trailer is not sufficiently sized to accommodate the needs of regular job conferences, shall provide and maintain, in addition to their job trailer, a meeting trailer for such use, for the duration of the Project. The meeting trailer shall be complete with a heating and air-conditioning unit capable of maintaining a temperature range of between 70ºF and 75ºF year round. At a minimum, include the following fixtures, furniture and equipment:

    a. Conference table to comfortably accommodate at least twelve (12) adults
    b. Twenty (20) chairs
    c. One (1) water cooler
    d. One (1) copier/scanner
    e. Four (4) trash receptacles
    f. Blinds for each window
    g. Three (3) desks, one (1) drafting table, one (1) plan rack
    h. Two (2) four-drawer locking file cabinets
    i. Two (2) 36” x 48” dry erase boards

2. The Contractor shall provide and maintain a minimum 8'x20' field office trailer, complete with a heating and air-conditioning unit capable of maintaining a temperature range of between 70ºF and 75ºF year round, for use by the Owner's full time representative or Clerk-of-the-Works. At a minimum, include the following fixtures, furniture and equipment:

    a. One (1) desk with typewriter return
    b. Two (2) chairs
    c. One (1) trash receptacle
    d. One (1) window at a minimum
    e. Blinds for each window
    f. One (1) four-drawer locking file cabinet
    g. One (1) 36" x 48" dry erase board

3. The General Contractor shall provide all required electrical and plumbing. Use charges for all metered electrical and water will be paid by the Owner.
4. Provide daily housekeeping services, provide snow removal services and relocate the field office trailer to a secondary location should the original location serve to impede the progress and/or completion of the Project.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar non-absorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent and size required by location and class of fire exposure.

J. First Aid Supplies: Comply with regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for the installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. The Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with the utility company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters and main distribution switch gear.

1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 V, ac 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When an overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system.

E. Temporary Heat: As described in the Temporary Heat paragraph below.

F. Heating Facilities: As described in the Temporary Heat paragraph below.

G. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

1. Provide separate facilities for male and female personnel.

I. Environmental Protection: In addition to the provisions indicated on the drawings, provide earthen embankments and similar barriers in and around excavations and sub-grade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY HEAT

A. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations, or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient conditions required and minimize consumption of energy.

1. Provide temporary heat at varying stages of the Project to allow construction operations to proceed in an orderly, sequential manner. **The following stages are milestones that must be clearly identified on the Contractor's Construction Schedule** as described in Division 1 Section "Construction Progress Documentation." The stages of the project are defined as follows:

   a. Early Stage: The duration of the Project from the start of construction to enclosure of the building. During this stage, the Contractor is responsible to provide temporary heat and any temporary enclosure required to contain the heated air necessary for construction activities. The Contractor is responsible to furnish the equipment and fuel for temporary heating.
   b. Intermediate Stage: The duration of the Project from the time the building is wholly or partially enclosed as determined solely by the Architect but prior to the operation of the permanent HVAC equipment for construction heating. During this stage, the Contractor shall provide temporary heating to establish an ambient air temperature and appropriate humidity level in the building, or portion thereof, to maintain construction activities, including the provision of necessary equipment and fuel. A minimum ambient air temperature of 50 degrees F must be capable of being maintained throughout the area of Work receiving temporary heat and humidity control. Maintain an appropriate humidity level acceptable to material manufacturers for the installation of materials and finishes.
   c. Final Stage: The duration of the Project after building enclosure is attained and the permanent HVAC equipment is available to provide temporary heat AND air conditioning as determined solely by the Architect. The Final Stage of construction shall be achieved at least 120 days prior to the date of Substantial Completion of each area of the building or phase of construction. An ambient air temperature of 70 degrees F must be capable of being maintained uniformly. The Contractor is responsible to provide start-up, maintenance and operation of all permanent HVAC units and provide temporary automatic temperature control wiring and devices to properly regulate the permanent devices. Further, the Contractor shall protect all ductwork, and shall install temporary filter media with a minimum rating of MERV 8 according to ASHRAE 52.2, at every return grill or air inlet to the air handling system. All temporary filters shall be fully sealed around the perimeter to seal off any dust from entering the return ductwork. All duct protection measures shall be reviewed with the CxA prior to starting up the units for use as temporary heat. Replace all

filters immediately prior to Building Occupancy. The Owner will pay all use charges and fuel costs for temporary heat during the Final Stage of construction. The Contractor is responsible to have all permanent HVAC units that will provide temporary heat, wired with their required power with service disconnects and all other NEC requirements. If power cannot be provided using the permanent electrical panel, wiring or distribution, then the Contractor must provide temporary means to meet the needs of the units. The Contractor is responsible to have all permanent gas-fired HVAC units that will be used to provide temporary heat, connected to a source for gas that will provide the necessary pressure and volume to operate the units as if they are in normal use, including compliance with applicable codes. If gas cannot be provided using the permanent gas system for the building, then the Contractor must provide temporary means to meet the needs of the units.

2. Temporary heat shall be initiated and maintained to allow the performance of Work for which a particular minimum ambient temperature must be maintained to meet the criteria described in individual sections of the technical specifications and as set forth by manufacturer's recommendations.
3. Temporary heat shall be provided to ensure that construction activities conform with the Contractor's Construction Schedule and to the scheduling sequence established by the Lead Contractor and as further directed by the Architect.
4. The term "building enclosure" refers to a level of completion of the building, or a designated portion thereof, that consists of the following:

    a. Construction of roof structure, roof, insulation and roofing membrane
    b. Construction of back-up masonry or exterior metal studs with exterior sheathing
    c. Temporary enclosure of exterior wall openings. Refer to the "Temporary Enclosures" paragraph below for additional information.

B. Heating Facilities: Except where use of the permanent system is authorized, provide properly vented, self-contained LP gas or natural gas heaters with individual space thermostatic control.

1. Use of gasoline, oil or kerosene fueled space heaters is prohibited.

3.4 SUPPORT FACILITIES INSTALLATION

A. Storage and Fabrication Facilities: Install storage and fabrication sheds or mobile trailers, sized, furnished and equipped to accommodate materials and equipment involved. Facilities may be open shelters or fully enclosed.

B. Drinking Water Facilities: Provide containerized tap dispenser bottled water type drinking water units, including disposable paper supply.

C. Dewatering Facilities and Drains: Maintain the site, excavations and construction free of water, ice and snow.

D. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely, with non-combustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load bearing wood framed construction.

E. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.

G. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

H. Rodent and Pest Control: Before foundation Work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.

I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

J. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access. If not indicated on the drawings, verify temporary facility locations with the Owner prior to installation.

1. Maintain support facilities until near Substantial Completion.

K. Temporary Roads: Construct and maintain temporary roads to support the required loading adequately and to withstand exposure to traffic during the construction period. To the greatest extent possible, locate temporary roads, storage areas and parking where the same permanent facilities will be located.

1. Paving: Comply with Project specifications for construction and maintenance of temporary paving.
2. Coordinate temporary paving development with sub-grade grading, compaction, installation and stabilization of sub-base and installation of base and finish courses of permanent paving.
3. Install temporary paving to minimize the need to rework the installations and result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. General: Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10, "Standard for Portable Fire Extinguishers," and NFPA 241, "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
3. Provide supervision of welding operations, combustion-type temporary heating units and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Storage of Flammable and Combustible Materials and Liquids: Comply with NFPA 241, “Standard for Safeguarding Construction, Alterations, and Demolition Operations” and NFPA 30, “Flammable and Combustible Liquid Code”

1. Storage: Store flammable and combustible materials and liquids in weathertight, ventilated and secure facilities outside of the building. Provide temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire and losses.

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics and warning

signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

F. Enclosure Fence: When excavation begins, install a lockable entrance gate and post "No Trespassing" signs at 50' on center around the site perimeter.

G. Security Enclosure and Lockup: The High School will be occupied throughout construction The General Contractor is responsible to ensure that ALL areas involving construction are secure. No contractor shall, under any circumstances, leave any door with access to the occupied areas, open and unsecure. Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

H. Construction Barriers: Install construction barriers to provide separation between occupied areas and areas involved in construction. This applies to every phase of construction. Construction barriers shall be constructed of nominal 2" x 4" wood studs at 24" o.c. with ½" OSB or plywood secured to the occupied side of the barrier with 2" Philip's head screws at 12" o.c. Extend construction barriers from masonry wall to masonry wall and from existing structural floor up to 8'-0" a.f.f. Install a sealed poly-barrier from the top of the 8'-0" temporary barrier up to the underside of the structural floor or roof deck above. Where authorized by the Owner, provide secure locking doorways of similar construction with non-removable pin hinges, pad locked on the construction side. Where doorways are approved by the Owner, all keys shall be delivered to the Owner. When access through doorways is desired, access must be approved by the Owner.

1. Install construction barriers in accordance with applicable codes. Do not create dead-end corridors or other non-compliant egress conditions.

I. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid using tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons, homes or businesses near the site.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in the use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of the Contractor. The Owner reserves the right to take possession of project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

    a. Replace air filters and clean inside of ductwork and housings.
    b. Replace significantly worn parts and parts subject to unusual operating conditions.
    c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 017200 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include the following:

1. Copies of Record Drawings
2. Record Samples

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies general requirements for preparing and submitting Project Record Documents
2. Division 1 Section “Operation and Maintenance Data” specifies requirements regarding submittal of operation and maintenance manuals.
3. Division 1 Section "Contract Closeout" specifies general closeout requirements.
4. Divisions 2 through 33 Sections for specific Project Record Document requirements.

D. Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition. Make documents and samples available at all times for the Architect's inspections.

1.3 RECORD DRAWINGS

A. Markup Procedures: During construction, maintain a set of black-line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes. Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed

elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:

a. Dimensional changes to the Drawings
b. Revisions to details shown on the Drawings
c. Depths of foundations below the first floor
d. Locations and depths of underground utilities
e. Revisions to routing of piping and conduits
f. Revisions to electrical circuitry
g. Actual equipment locations
h. Duct size and routing
i. Locations of concealed internal utilities
j. Changes made by Change Order or Construction Change Directive
k. Changes made following the Architect's written orders
l. Details not on the original Contract Drawings

2. Mark record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
3. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note Construction Change Directive numbers, alternate numbers, change-order numbers, and similar identification.

B. Responsibility for Markup: The Contractor shall prepare the record drawings.

1. Accurately record information in an understandable drawing technique.
2. Record data as soon as possible after obtaining it. Record and check the markup prior to enclosing concealed installations.
3. At the time of Substantial Completion, submit record drawings to the Architect for the Owner's records. Organize the drawings into sets and bind and label the sets for the Owner's continued use.

C. Copies and Distribution: Print 3 black-line prints of each drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable-paper cover sheets. Include appropriate identification, including titles, dates, and other information on the cover sheets.

1. Organize and bind the original marked-up set of prints that were maintained during the construction period in the same manner.
2. Organize print sets. Place these sets in durable tube-type drawing containers with end caps. Mark the end cap of each container with suitable identification.
3. Submit the marked-up record set and three (3) copy sets to the Architect for the Owner's records; the Architect will retain one (1) copy set.

1.4 RECORD SAMPLE SUBMITTAL

A. Immediately prior to the date of Substantial Completion, meet with the Owner at the Project site to determine which of the samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Architect's instructions for packaging, identification marking, and delivery to the Owner's sample storage space. Dispose of other Samples in a manner specified for disposing surplus and waste materials.

1.5 MISCELLANEOUS RECORD SUBMITTALS

A. Refer to Individual Specification Sections in Divisions 2 through 33 for additional record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Architect for the Owner's records.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 RECORDING

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

END OF SECTION 017200

SECTION 017700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Contract closeout including, but not limited to, the following:

1. Inspection procedures

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 33.

C. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 1 Section “Applications for Payment for information regarding the application which first follows Substantial Completion and for information regarding the Final Application for Payment
2. Division 1 Section “Final Cleaning” for additional information regarding project closeout, cleaning and punch list requirements.

D. In the event that Additional Services by the Architect are made necessary by the actions of the Contractor, such as failure to meet Substantial Completion or Final Acceptance of the Work within the time frames required by the Contract Documents, the Contractor’s responsibility for costs of the Architect as defined throughout this Section shall be calculated to the hourly rates noted in the Architect’s Agreement with the Owner. Costs shall be deducted from the Contractor’s final payment without Change Order.

1.3 CONTRACTOR’S PUNCH LIST AND TIME FOR COMPLETION

A. General: The Contractor’s Punch List is a comprehensive list of observed items requiring completion or correction, prepared by the Contractor for their Work.

B. Using the Punch List Form attached to the end of this Section, or in an electronic format acceptable to the Architect, (i.e. Bluebeam, PlanGrid, etc.), list the location, the date, a description of the item and the Contractor responsible for the item. Upon request by the Contractor, this Punch List Form can be provided in MS Excel format.

C. Except for items whose completion is delayed under circumstances as determined acceptable solely by the Architect, it is a requirement of the Project that ALL Punch List items, from both the Contractor's and the Architect's Punch Lists, be completed or corrected by the Contractor within 30 days of the date established by the Architect for Substantial Completion.

1. Except as noted above, if the Project is not finally accepted by the Architect within 30 days of the date established for Substantial Completion, or if additional and repeated site visits or meetings are required to assure Final Acceptance, all costs incurred by the Architect, both direct and indirect, shall be chargeable to the Contractor. Refer to Paragraph 1.2.D above.

1.4 SUBSTANTIAL COMPLETION

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

B. Preliminary Procedures: Before requesting inspection for a Certificate of Substantial Completion, complete all of the following tasks. List ALL exceptions in the request.

1. In the Application for Payment that first follows the date Substantial Completion is claimed, show 100% completion for the portions of the Work claimed as substantially complete.

    a. Include supporting documentation for completion as indicated in the Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    b. If 100% completion cannot be shown, include a Punch List of incomplete items, the value of the incomplete construction and reasons the Work is not complete.

2. Advise the Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Submit record drawings, maintenance manuals, damage or settlement surveys, property surveys and similar final record information.
6. Deliver tools, spare parts, extra stock, and similar items.
7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
9. Complete final cleanup requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred, exposed finishes.

C. Contractor Punch List Requirements: When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, and before the Architect will inspect the Work or issue a Certificate of Substantial Completion, the Contractor shall submit a Punch List for review of observed items requiring completion or correction prior to final payment. Failure to include an item does not alter the responsibility of the Contractor to complete all Work in accordance with the requirements of the Contract Documents.

1. If the Project is not defined as phased construction in the Contract Documents and the Contractor requests that a portion of the Project be inspected by the Architect to be deemed substantially complete, the Architect's costs, both direct and indirect, related to said inspection by the Architect shall be the responsibility of the Contractor. Refer to Paragraph 1.2.D above.

D. Inspection Procedures: Upon request by the Contractor for inspection and receipt of the Contractor's Punch List, the Architect will either proceed with the inspection to determine whether the Work or designated portion thereof is substantially complete or advise the Contractor of unfulfilled requirements. If the Architect's inspection discloses any item, whether or not included on the Contractor's Punch List, which is not sufficiently complete in accordance with the requirements of the Contract Documents to allow the Owner to occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion by the Architect, complete or correct such item upon notification by the Architect.

1. The Architect will prepare the Certificate of Substantial Completion following successful inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

2. If reinspection is necessary to assure Substantial Completion, all costs incurred by the Architect, both direct and indirect, shall be chargeable to the Contractor. Refer to Paragraph 1.2.D above. Following successful reinspection, the Architect will prepare a Certificate of Substantial Completion. If the Work is still not substantially complete, the Architect will advise the Contractor of its obligations that have not been fulfilled and which are still required for Substantial Completion.

    a. If necessary, the reinspection will be repeated. If this additional reinspection is required, all costs incurred by the Architect, both direct and indirect, shall be chargeable to the Contractor. Refer to Paragraph 1.2.D above.
    b. Results of the completed inspection will form the basis of requirements for Final Acceptance.

1.5 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection and final payment, complete all of the following tasks. List ALL exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a copy of the Contractor's Punch List of items to be completed or corrected, prepared at the time of Substantial Completion, endorsed, and dated by the Contractor. This copy of the Contractor's Punch List shall state that each item has been completed or otherwise resolved for acceptance.
4. Submit consent of surety to final payment.
5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Final Inspection Procedures: Upon receipt of the endorsed copy of the Contractor's Punch List and a request for final inspection, the Architect will either proceed with the inspection or advise the Contractor of unfulfilled requirements.

1. The Architect will either endorse and date the completed Contractor's Punch List following final inspection, or advise the Contractor of construction that must be completed or corrected before Final Acceptance.
2. If reinspection is necessary to assure Final Acceptance, all costs incurred by the Architect, both direct and indirect, shall be chargeable to the Contractor. Refer to Paragraph 1.2.D above. If the Work is still not finally complete, the Architect will advise the Contractor of its obligations that have not been fulfilled and which are still required for Final Acceptance.

    a. If necessary, the reinspection will be repeated. If this additional reinspection is required, all costs incurred by the Architect, both direct and indirect, shall be chargeable to the Contractor. Refer to Paragraph 1.2.D above.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for the Installer of each piece of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in the proper operation and maintenance of the installed equipment. Provide instruction by manufacturer's representatives if installers are not experienced in the operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools

5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments

B. As part of the instruction for operating equipment, demonstrate the following procedures:

1. Startup
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

3.2 CONTRACT REQUIREMENT AND CLOSEOUT CHECK LIST

A. Information: The attached Contract and Closeout Check List is a summary of the items required for Substantial Completion.

END OF SECTION 017700

Crabtree, Rohrbaugh & Associates - Architects
250 West Main Street, Suite 200
Charlottesville, VA 22902
Virginia • Pennsylvania • Maryland • West Virginia

PUNCH LIST

DATE |

Staunton City Schools | Shelburne Middle School Additions and Renovations
CRA Project No. 3636

Date	Room No.	Issue	Prime Responsible	Owner Reviewed	Architect Reviewed	Date Completed	Value
01/01/2018	D101	(4) Ceiling tiles missing adjacent of exterior windows.	GC	☒	☒	01/20/2018	0.00
				☐	☐		
				☐	☐		
				☐	☐		
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SECTION 017800 - FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for final cleaning at Substantial Completion.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Temporary Facilities & Controls" specifies general cleanup and waste removal requirements.
2. Division 1 Section "Contract Closeout" specifies general contract closeout requirements.
3. Special cleaning requirements for specific construction elements are included in appropriate Sections of Divisions 2 through 33.

C. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinners, in storm or sanitary drains.
2. Burning or burying of debris, rubbish or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final-cleaning services. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations **before** requesting inspection for Substantial Completion for the Project or a portion of the Project.

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
3. Remove petrochemical spills, stains, and other foreign deposits.
4. Remove tools, construction equipment, machinery, and surplus material from the site.
5. Remove snow and ice to provide safe access to the building.
6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
7. Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
8. Broom clean concrete floors in unoccupied spaces.
9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
11. Remove all non-permanent labels.
12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over "UL" and similar labels including mechanical and electrical nameplates.

13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers and grills.
16. Clean ducts, blowers and coils if units were operated without filters during construction.

17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
19. Leave the Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 017800

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:

1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
3. Instruction of the Owner's operating personnel in the operation and maintenance of building systems and equipment.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies preparation of Shop Drawings and Product Data.
2. Division 1 Section "Contract Closeout" specifies general closeout requirements.
3. Appropriate Sections of Divisions 2 through 33 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.

1.3 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.

1. Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.
2. Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.

B. Instructions for the Owner's Personnel: Use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved to instruct the Owner's operation and maintenance personnel.

1.4 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:

1. **Before Substantial Completion**, when each installation that requires operation and maintenance manuals is nominally complete, submit two (2) draft copies of each manual to the Architect for review. Include a complete index or table of contents of each manual.

    a. The Architect will return one (1) copy of the draft with comments within 15 days of receipt.

2. Submit one (1) copy of data in final form **at least 15 days before final inspection**. The Architect will return this copy within 15 days after final inspection, with comments.
3. After final inspection, make corrections or modifications to comply with the Architect's comments. Submit the specified number of copies of each approved manual to the Architect **within 15 days of receipt of the Architect's comments**.

B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11- inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

    a. Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
    b. Identify each binder on the front and the spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and the subject matter covered. Indicate volume number for multiple volume sets of manuals.

2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch white bond paper.
5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

    a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.

b. If drawings are too large to be used practically as a foldout, place the drawings, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

A. In each manual, include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:

1. General system or equipment description
2. Design factors and assumptions
3. Copies of applicable Shop Drawings and Product Data
4. System or equipment identification, including:

    a. Name of manufacturer
    b. Model number
    c. Serial number of each component

5. Operating instructions
6. Emergency instructions
7. Wiring diagrams
8. Inspection and test procedures
9. Maintenance procedures and schedules
10. Precautions against improper use and maintenance
11. Copies of warranties
12. Repair instructions including spare parts listing
13. Sources of required maintenance materials and related services
14. Manual index

B. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text and copies of each warranty, bond and service contract issued.

1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:

    a. Subject matter covered by the manual
    b. Name and address of the Project
    c. Date of submittal
    d. Name, address, and telephone number of the Contractor
    e. Name and address of the Architect
    f. Cross-reference to related systems in other operation and maintenance manuals

2. Table of Contents: After the title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of

each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.

a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.

3. General Information: Provide a General Information section immediately following the table of contents listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.
4. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.
5. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.

   a. Do not use original project record documents as part of operation and maintenance manuals.

7. Warranties, Bonds, and Service Contracts: Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. Submit three (3) copies of each manual, in final form, on materials and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.

1. Refer to individual Specification Sections for additional requirements on the care and maintenance of materials and finishes.

B. Architectural Products: Provide manufacturer's data and instructions on the care and maintenance of architectural products, including applied materials and finishes.

1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:

    a. Manufacturer's catalog number
    b. Size
    c. Material composition
    d. Color
    e. Texture
    f. Reordering information for specially manufactured products

2. Care and Maintenance Instructions: Provide information on the care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include the manufacturer's recommended schedule for cleaning and maintenance.

C. Moisture Protection and Products Exposed to Weather: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.

1. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:

    a. Applicable standards
    b. Chemical composition
    c. Installation details
    d. Inspection procedures
    e. Maintenance information
    f. Repair procedures

D. Schedule: Provide complete information in the materials and finishes manual on products specified in the following Sections:

1. Polished Concrete: Division 3 Section “Polished Concrete Finishing”
2. Face Brick and Masonry: Division 4 Section “Unit Masonry Assemblies”
3. EPDM Sheet Roofing: Division 7 Section “Single-Ply Membrane Roofing”
4. Metal Wall Panels: Division 7 Section “Metal Wall Panels”
5. Finish Hardware: Division 8 Section “Door Hardware”
6. Carpet: Division 9 Section “Carpet”
7. Ceramic Tile: Division 9 Section “Tiling”
8. Wood Flooring: Division 9 Section “Wood Athletic Flooring”

1.7 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit six (6) copies of each manual, in final form, on equipment and systems to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system and each electric and electronic system.

1. Refer to individual Specification Sections for additional requirements on the operation and maintenance of the various pieces of equipment and operating systems.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:

    a. Equipment or system function
    b. Operating characteristics
    c. Limiting conditions
    d. Performance curves
    e. Engineering data and tests
    f. Complete nomenclature and number of replacement parts

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:

    a. Printed operation and maintenance instructions
    b. Assembly drawings and diagrams required for maintenance
    c. List of items recommended to be stocked as spare parts

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

    a. Routine operations
    b. Troubleshooting guide
    c. Disassembly, repair, and reassembly
    d. Alignment, adjusting, and checking

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:

    a. Startup procedures
    b. Equipment or system break-in
    c. Routine and normal operating instructions
    d. Regulation and control procedures
    e. Instructions on stopping
    f. Shutdown and emergency instructions
    g. Summer and winter operating instructions
    h. Required sequences for electric or electronic systems
    i. Special operating instructions

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
7. Coordination Drawings: Provide each Contractor's Coordination Drawings.

    a. Provide as-installed, color-coded, piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.
9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:

    a. Electric service
    b. Controls
    c. Communication

1.8 INSTRUCTIONS FOR THE OWNER'S PERSONNEL

A. **Prior to final inspection**, instruct the Owner's personnel in the operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.

1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
2. Use the operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017823

SECTION 017900 - WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions of the Contract for Construction for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
2. Division 1 Section "Contract Closeout" specifies contract closeout procedures.
3. Divisions 2 through 33 Sections for specific requirements for warranties and special warranties on products and installations specified to be warranted.
4. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with the requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with the requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Architect **prior to the date certified for Substantial Completion.** If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion of the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name and the name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of a building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for use of premises, and phasing, and Owner-occupancy requirements.
2. Division 1 Section "Temporary Facilities & Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities and environmental-protection measures for selective demolition operations.
3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
4. Divisions 23 and 26 for demolishing, cutting, patching, or relocating mechanical and electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner that may be encountered during selective demolition remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1. Before demolition and throughout construction, all Prime Contractors shall be responsible to review with the Owner's, all items being removed by their trades. All items designated during this review to remain the Owner's property, shall be maintained in good condition and turned over to the Owner.

1.5 SUBMITTALS

A. Qualification Data: For Contractor.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of proposed dust and noise-control temporary partitions and means of egress.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
6. Means of protection for items to remain and items in path of waste removal from the building.
7. Use of elevators and stairs.

Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Pre-demolition Photographs or Recordings: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that specializes in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. The Owner will occupy portions of the building immediately adjacent to the selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 1 Section "Summary of Work."

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner as far as is practical.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Architect and Owner. The Owner will remove the hazardous materials under a separate contract, or request a proposal to remove the hazardous materials.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

F. All Contractors shall be responsible for verification of all existing building dimensions and conditions, including finishes and materials, systems shown and designated as existing on the Contract Drawings prior to starting demolition and construction. Any discrepancies in information indicated on the Contract drawings shall be directed in writing to the attention of

the Architect prior to the start of demolition and construction. Verification of clearances required for all new equipment, piping, ductwork and related components shall be the Contractor's responsibility.

G. All Contractors shall patch, repair or replace all existing finishes and materials disturbed or damaged during demolition. All repair or replacement shall match adjacent existing and/or new finishes and materials as indicated.

H. See Architectural, Structural, Mechanical, Electrical and Plumbing drawings for demolition work required. Coordinate all Work by other Contractors, including, but not limited to, capping and disconnection of building services.

I. Existing conditions as appear in these Contract Documents may vary with actual conditions because of undocumented work performed by Owner's staff and by other contractors.

J. All Contractors shall be responsible for verification of all demolition conditions related to accepted Alternate bids, including finishes and materials, systems shown and designated as existing or new on the Contract Drawings prior to starting of demolition and construction. Any discrepancies in information indicated on the Contract Drawings shall be directed in writing to the attention of Architect prior to starting demolition and construction.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine the extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Engage a professional engineer to survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, or preconstruction videotapes.

1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproductions.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary of Work."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. The Owner will arrange to shut off indicated services/systems when requested by the Contractor. The Contractor may make these arrangements if approved by the Owner.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition, provide temporary services/systems that bypass the area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

a. Where an entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities & Controls"

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective `demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities & Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly.

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated in the Contract Documents without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete at junctures with construction to remain, using power-driven saw. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 Sections for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories as indicated in the demolition and renovation notes.

F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

G. Refer to the drawings for additional demolition work if any for each room or building component.

H. Prepare existing remaining substrates to receive new finishes as indicated on the finish schedule. Preparation of substrates shall be in conformance with the installation requirements of each new finish.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03 3000 - 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.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1. 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.

2. Review special inspection and 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, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

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 to provide the water to cement ratio of the design mix, this must be clearly indicated on EVERY delivery ticket to the 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. Location of construction joints is subject to approval of the Architect.

E. Samples: For waterstops and vapor retarder.

F. LEED Submittals: Comply with Section 01 3329.
1. MR Credit 2: BPDO – Environmental Product Declarations
   a. For cement, slag, and steel reinforcement: Product-specific declaration or Industry-wide EPD or product-specific EPD.
2. MR Credit 3: BPDO – Sourcing of Raw Materials
   a. For products having recycled content (slag and steel): Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
   b. For products having regionally sourced recycled material (slag, steel): Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.
3. MR Credit 4: BPDO – Material Ingredients
   a. For admixtures and coatings provide Material Ingredient Report.
4. EQ Credit 2: Low-Emitting Materials
   a. For interior wet-applied coatings: Documentation indicating compliance with California Department of Public Health (CDPH) Standard Method v1.2–2017 and printed statement of VOC content in g/L. Include volume of material applied per product.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

B. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

D. Field quality-control reports.

E. Minutes of pre-installation conference.

1.7 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 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. 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.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Store reinforcement in a manner that prevents soil, mud, debris, or oil from adhering to the bars. If for any reason soil, mud, debris, or oil is on a bar it will be removed before the bar is installed.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

C. Cement: Store to prevent deterioration or contamination. Cement which has become caked, partially set, or otherwise deteriorated, damaged, or contaminated shall not be used.

D. Aggregates: Store and handle to preserve gradation and cleanliness. Integration of grades and/or contamination are caused for rejection, and such rejected material shall be removed and not used.

1.10 FIELD CONDITIONS

A. 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, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. 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.

B. Hot-Weather Placement: Comply with ACI 305R and ACI 305.1, 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301
2. ACI 117

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

C. Provide Environmental Product Declarations: Product-specific declaration or Industry-wide EPD or product-specific EPD.

D. Provide products having recycled content. Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.

E. Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. 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.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I.
    a. Provide Environmental Product Declarations: Product-specific declaration or Industry-wide EPD or product-specific EPD.
2. Fly Ash: ASTM C 618, Class F or C. Use only in concrete mixes for foundation footings, CMU wall grout fills and slab-on-grades.
3. Slag Cement: ASTM C 989, Grade 100 or 120.
    a. Provide Environmental Product Declarations: Product-specific declaration or Industry-wide EPD or product-specific EPD.
    b. Provide products having recycled content. Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
    c. Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, uniformly 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. Nominal Maximum Coarse Aggregate Size: 1 1/2 inch (3/4 inch where placement by pumping) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330, 1 inch (3/4 inch where placement by pumping) nominal maximum aggregate size.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Provide Material Ingredient Report. Product-specific declaration or Industry-wide EPD or product-specific EPD.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

G. 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, Type C. Provide Material Ingredient Report. Product-specific declaration or Industry-wide EPD or product-specific EPD.

H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete. Provide Material Ingredient Report. Product-specific declaration or Industry-wide EPD or product-specific EPD.

I. Water: ASTM C 94. The water shall be clean, potable, and free from deleterious substances.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: For embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes. Use profile of ribbed surface with center bulb. The waterstop is to be embedded 3 inches into concrete unless noted otherwise on drawings.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Installation shall comply with specification.
2. Products: Subject to compliance with requirements, provide one of the following:
    a. Stego Industries, LLC; Stego Wrap 20-mil Class A Vapor Barrier
    b. Barrier-Bac, Inc.; VB-350 31 mil Class A Vapor Retarder
    c. W.R. Meadows, Inc.; Perminator EVOH 20 mil Class A Vapor Retarder

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel.

2.8 FLOOR AND SLAB TREATMENTS

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, according to ASTM D 2240.

C. 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.

D. Reglets: Fabricate reglets of not less than 0.022 inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 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.

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 5700 psi at 28 days when tested according to ASTM C 109.

2.13 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: 18 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing 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.

E. For interior wet-applied coatings: Documentation indicating compliance with California Department of Public Health (CDPH) Standard Method v1.2–2017 and printed statement of VOC content in g/L. Include volume of material applied per product.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: *3000* psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Maximum Slump: As indicated.
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.
5. Air Content: 6 percent, plus 1 or minus 1.5 percent at point of delivery.

B. Interior Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: *3000* psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
4. Maximum Slump: 4 inches.
5. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Suspended Slabs: *Normal-weight* concrete.

1. Minimum Compressive Strength: 3500 psi at 28 days.

2. Calculated Equilibrium Unit Weight: 110 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, 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 INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct 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.

F. 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.

G. 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.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

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 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Vapor Barrier: place, protect, and repair membrane according to ASTM E 1643, ASTM F 710 and manufacturer's written instructions. Contractor shall place the vapor barrier directly below the concrete slab and on top of granular fill. Lap joints 6 inches minimum and seal with manufacturer's recommended tape. Sheets to extend to interior face of foundation walls, turn up vertically and terminate flush with top of concrete floor slab. Adhere to foundation wall with manufacturer's recommended tape. Seal all penetrations with manufacturer's recommended methods of boots, mastic or tape.

B. Granular Fill: Place a minimum of 4 inches compacted granular fill on top of subgrade to elevation tolerances of plus 0 inch or minus ½ inch.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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, 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.

3.7 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. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use epoxy-bonding adhesive 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 by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.
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 does 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.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

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 is 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 not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
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.

3.10 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 ACI347R limits for class of surface specified.

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 exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete. Do not apply rubbed finish to smooth-formed finished concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other 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 restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

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 indicated and to floor and slab 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, measured within 24 hours according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10 feet long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch. In addition, visually obvious faults in floor flatness shall be corrected at contractor's own expense.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thinset 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.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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 of 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.

3.13 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 305.1 and ACI 305R 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 remainder of 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-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 does not interfere with bonding of floor covering used on Project.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semi-rigid 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.

3.15 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 1 part portland cement to 2-1/2 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 matches 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.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
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: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 30 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; 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; ASTM C 173, volumetric method, for structural lightweight 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; one test hourly when air temperature is 40 deg F and below or 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.

    a. Cast and laboratory (standard) one set of three standard cylinder specimens for each composite sample. Transport the cylinders to laboratory within 24 hours for final curing and testing
    b. Cast and field cure one set of two standard cylinder specimens for each composite sample. Field cure the cylinders for the first five (5) days, minimum, in the field under the same conditions as the cast concrete. Transport the cylinders to the laboratory for continued curing and testing.

7. Compressive-Strength Tests: ASTM C 39; test one laboratory (standard) cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one field cured specimens at 7 days and one at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. 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.
10. If time of concrete strength gain is affected by materials in the mix, such as fly ash, provide correlation information between the 28-day compressive strength and the final compressive strength prior to performing compressive strength tests.
11. 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.
12. 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.
13. 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 or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. 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 24 hours of finishing.

END OF SECTION

SECTION 034500 - PRECAST ARCHITECTURAL 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. This Section includes the following:

1. Precast architectural concrete units.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for full-size brick facing, mortar, and anchorages.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing receivers and reglets.
3. Division 7 Section "Joint Sealants" for elastomeric joint sealants and sealant backings.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.

1. Indicate separate face and backup mix locations and thicknesses.
2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.

3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
4. Indicate locations and details of anchorage devices to be embedded in other construction.
5. Comprehensive engineering analysis certified by the qualified professional engineer responsible for its preparation.

D. Samples for Initial Selection: For colored mortar.

E. Samples for Verification: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

F. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.5 INFOMATIONAL SUBMITTALS

A. 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.

B. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Concrete materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Water-absorption test reports.

C. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed precast architectural concrete work 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. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast architectural concrete that are similar to those indicated for this Project in material, design, and extent.
3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units, or in APA's Plant Certification Program for Production of Architectural Precast Concrete Products and is designated an APA-certified plant.
4. Has sufficient production capacity to produce required units without delaying the Work.
5. Is registered with and approved by authorities having jurisdiction.

C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

H. Mockups: Furnish cast stone for installation in mockups specified in Division4 Section "Unit Masonry Assemblies."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Pack, handle, and ship cast-stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining or wearing. Move cast-stone units if required, using dollies with wood supports.
2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
3. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.8 SEQUENCING

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

B. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Source Limitations: Obtain precast architectural concrete units from single source from single fabricator.

B. Available Fabricators: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Gate Precast Company
2. Tindall Corporation
3. Coastal Precast Systems, LLC
4. Atlantic Metrocast, Inc.

2.2 CONCRETE MATERIALS

A. General: Comply with ASTM C 1364

B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.

1. Standard gray portland cement may be used for nonexposed backup concrete.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast-stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast-stone textures and colors.

E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260.
4. Water-Reducing Admixture: ASTM C 494, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.3 MOLD MATERIALS

A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated.

2.4 ARCHITECTURAL PRECAST CONCRETE UNITS

A. Comply with ASTM C 1364.

1. Units shall be manufactured using the wet-cast method.
2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

    a. No fewer than five days at mean daily temperature of 70 deg F or above.
    b. No fewer than six days at mean daily temperature of 60 deg F or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Color and Texture:

1. Color as selected by Architect from manufacturer's full range.
2. Provide units with fine-grained texture.

    a. Provide surfaces free of pockets, sand streaks, and honeycombs, with uniform color and texture.
3. Finish unexposed surfaces of precast architectural concrete units by float finish.

2.5 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.

B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

C. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.

D. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

E. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi
2. Maximum Water-Cementitious Materials Ratio: 0.45.

F. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

G. Lightweight Concrete Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft., plus or minus 3 lb/cu. ft., according to ASTM C 567.

H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

I. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.6 ACCESSORIES

A. Dowels: 1/2-inch- diameter epoxy coated round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:

1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60, deformed.

C. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed.

D. Epoxy-Coated-Steel Welded Wire Fabric: ASTM A 884/A 884M, Class A coated, deformed.

E. Embedded Anchors and Other Inserts: Fabricated from Type 304 stainless steel complying with ASTM A 240, ASTM A 276, or ASTM A 666, Type 304.

F. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.7 MORTAR MIXES AND MATERIALS

A. Comply with Section 042000 "Unit Masonry."

2.8 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations. Delete form liners unless needed to produce exposed surface finish.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered.

2.9 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

B. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least 3/4-inchminimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

C. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

D. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

E. Place face mix to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.

F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.

1. Place backup concrete to ensure bond with face mix concrete.

G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

H. Comply with ACI 306.1 procedures for cold-weather concrete placement.

I. Comply with ACI 305R recommendations for hot-weather concrete placement.

J. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.

K. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

L. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

2.10 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

B. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318requirements.

C. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

D. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

3.2 SETTING CAST STONE IN MORTAR

A. Install units to comply with requirements in Section 042000 "Unit Masonry Assemblies."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Fill dowel holes and anchor slots with mortar.
2. Build concealed flashing into mortar joints as units are set.
3. Keep head joints and between other units with exposed horizontal surfaces open to receive sealant.
4. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
5. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

E. Point mortar joints by placing and compacting mortar. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

F. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

G. Provide sealant joints at head joints and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of not less than 3/8 inch.
4. Prime surfaces to receive sealant and install compressible backer rod in joints before applying sealant.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 “Joint Sealants.”

3.3 ERECTION TOLERANCES

A. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.

C. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

D. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

E. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

F. Remove and replace work that does not comply with specified requirements.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 03450

SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

B. Related Sections include the following:
1. Division 9 Sections for finished flooring

1.3 SCOPE OF WORK

A. The General Contractor shall provide and install all hydraulic cement underlayment for this Project.
1. Shot-Blasted Floors, Non-Asbestos-Containing Mastic: As part of this project, non-asbestos-containing vinyl composition tile installed with non-asbestos-containing mastic is being removed by the Contractor from noted rooms throughout the building. The Contractor shall prepare the subfloor as required to receive the new flooring (i.e. removal of mastic, priming, etc.), and in such a manner as to ensure that all flooring warranties (material and installation) are secured. It is not anticipated that shot-blasting will be required however the Contractor shall be responsible to level all floors damaged as part of the mastic removal or Contractor's preparation process. Existing damage requiring repair that is beyond the extent of the floor leveling allowance will be done through unit price. Refer to the Asbestos-Containing Materials Plan (Drawing ASB-1) for rooms specifically known to contain asbestos-containing floor tile and mastic which will be removed by the Asbestos Abatement Contractor.
2. Incidental Applications: In accordance with Division 1 Section "Unit Prices", provide and install an average of 1/8-inch thick (not including the depth of small voids and pockmarks) hydraulic cement underlayment over other existing irregular, uneven floor surfaces that are not considered by finish flooring manufacturers to comply with substrate tolerances or other requirements for the various types of flooring, including, but not limited to, resilient flooring and carpet products. Blend out and feather all patch edges out to existing and suitable concrete substrates.

B. All hydraulic cement underlayment shall be installed per manufacturer’s written installation instructions, and as required to maintain the new flooring manufacturer’s material and installation warranties.

1.4 PREINSTALLATION MEETING

A. Pre-installation Conference: Conduct conference at Project site to comply with Division 1 Section “Project Meetings”.

1.5 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

C. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayment only when ambient temperature and temperature of substrates are between 50 and 80 deg. F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 492 and classified according to ASTM E 989 by an independent testing agency.

C. Setting Times:

1. Initial Set: ASTM C 191; approximately 30 minutes.
2. Final Set: ASTM C 191; approximately 90 minutes.
3. Flow Time: Approximately 10 minutes.
4. Walkable: 2 to 3 hours.
5. Floor Covering Installation Timeline:

    a. Moisture-insensitive tile and stone: 6 hours.
    b. All other floor coverings: 16 hours.

D. Structural Performance:

1. Compressive Strength: ASTM C 109, air cure only; 5,500 psi at 28 days.
2. Flexural Strength: ASTM C 348; 1,000 at 28 days.

2.2 HYDRAULIC CEMENT UNDERLAYMENT

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations. Maximum thickness shall be approximately 5 inches with manufacturer-approved aggregate. Underlayment without aggregate shall be able to be neatly installed in thicknesses ranging from approximately 1/8 inch to 1 1/2 inches.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ARDEX Americas.
    b. Schönox HPS North America
    c. BASF Construction Chemicals – Building Systems.
    d. Bonsal American, an Oldcastle company.
    e. L & M Construction Chemicals, Inc.
    f. MAPEI Corporation.
    g. Maxxon Corporation.
    h. Metalcrete Industries.
    i. TEC; H.B. Fuller Construction Products, Inc.

2. Cement Binder: ASTM C 150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4,000 psi at 28 days when tested according to ASTM C 109.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4-inch; or coarse sand as recommended by underlayment manufacturer. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg. F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.
2. Primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

1. Coating shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D.
2. Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

G. Patching Compounds: Provide comparable products for general patching and skim-coating if underlayment system cannot adequately perform required patching operations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Apply surface sealer at rate recommended by manufacturer.

G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

SECTION 042000 - UNIT MASONRY (ASSEMBLIES)

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 unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Face brick.
4. Mortar and grout.
5. Reinforcing steel.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 3 Section “Cast-In-Place Concrete”
2. Division 5 Section “Metal Fabrications”
3. Division 5 Section “Structural Steel Framing”
4. Division 5 Section “Cold Formed Metal Framing”
5. Division 7 Section "Sheet Metal Flashing and Trim"
6. Division 7 Section "Through Penetration Firestop Systems"
7. Division 7 Section “Joint Sealants”
8. Division 8 Section “Hollow Metal Doors and Frames”

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1. For Concrete Unit Masonry: 2000 psi (MPa).

1.1 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified, to comply with requirements in Division 1 Section “Submittals”.

B. Pre-installation Coordination Drawings: In accordance with Division 1 Section “Project Coordination”, prepare Coordination Drawings to coordinate unit masonry assemblies with Work of other trades. Coordination drawings shall be reviewed by all Prime Contractors at the Masonry Pre-Installation Conference. Coordination items include, but are not limited to the following:

1. Sizes and locations of all masonry openings, coordinated with items installed by other trades, both interior and exterior, i.e., louvers, grilles, doors and windows, scuppers, etc. **At a minimum, coordination drawings must show ALL required openings through the finished exterior building masonry.**
2. Locations of all expansion and control joints. Locations of all expansion and control joints. **Submit for approval, a method recommended by recent technical standards published by Industry standards as noted in Paragraph 3.2.A below.**
3. Locations of all in-wall rainwater conductors and outlets through the wall.
4. Locations of all piped sleeves and other foundation penetrations.

C. Shop Drawings: In accordance with Division 1 Section “Submittals”, prepare and submit Shop Drawings including details of the following, at a scale of not less than 3” = 1’-0”.

1. Locations and types of lintels.
2. Indicate required horizontal and vertical reinforcing and horizontal masonry bond beams.
3. Fabricated flashing details, sections and installation methods including, but not limited to, through-wall base flashings, sill flashings, head flashings, low roof/high wall flashings, cap flashings, corner flashings, end dam flashings, stepped flashings and 2-piece flashing assemblies.
4. Locations and detailed methods of attachment to supporting structural items and systems.
5. Submit details and installation methods incorporating special shape units.
6. Submit documentation of constructability issues related to design, installation methods, applicable building codes, fire-rating and/or compatibility conditions. Accompany documentation with the most recent technical standards published by the International Masonry Institute, National Concrete Masonry Association, Brick Industry Association and product manufacturer’s printed recommendations.

    a. Compatibility Reports: Certification from foamed-in-place polyurethane insulation manufacturer indicating insulation is chemically and adhesively compatible with all adjoining cavity wall assembly materials including, but not limited to, membrane and metal flashing materials, sealants, backer rods, masonry reinforcing, masonry ties, gaskets and similar materials. List all materials, if any, which may be damaged by coming into contact with foamed-in-place insulation, either by short-term or long-term contact. Refer to Division 7 Section “Foamed-In-Place Insulation.”

D. Samples for Initial Selection of the following:

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required. Submit face brick to show range of colors, texture and mortar types for matching existing brick. Submit concrete masonry samples to illustrate texture.
2. Colored mortar samples showing the full range of colors available.

E. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar samples for each color required, showing the full range of colors expected in the finished construction. **Make samples using the same sand and mortar ingredients to be used on Project.** Label samples to indicate types and amounts of pigments used.
3. Weeps/vents in color to match mortar color.
4. Accessories embedded in masonry assemblies.

F. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from requirements of the Contract Documents, unless such deviations are specifically brought to the attention of Architect and approved in writing.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements specified:

1. Each type of masonry unit required.

    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
    b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units and gross-area compressive strength of clay bricks.

2. Mortar complying with ASTM C270.
3. Grout mixes complying with compressive strength requirements of ASTM C476. Include description of type and proportions of grout ingredients.
4. Submit concrete mix design for filling masonry cells and bond beams. Use concrete mix having a 28-day compressive strength of 3000 psi.

I. Material Certificates: Signed by manufacturers certifying that each of the following items complies with specified requirements:

1. Each type of masonry unit required.

    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
    b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
4. Each material and grade indicated for reinforcing bars.
5. Each type and size of joint reinforcement.
6. Each type and size of anchor, tie, and metal accessory.

J. Hot and Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with hot and cold-weather requirements.

1.2 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1093 to conduct the testing indicated, as documented according to ASTM E548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color through one source from a single manufacturer and manufacturing plant.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Testing Service: Owner will engage a qualified independent testing agency to perform tests in compliance with applicable codes.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per Applicable Code by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

F. Sample Panels: Prior to installation of above grade unit masonry, build sample panels, using single wythe veneer materials preliminarily selected for the completed Work. Build sample panels for each type of veneer masonry in sizes approximately 48 inches long by 48 inches high by full unit thickness.

1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
2. Clean exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.

4. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Being preliminary in nature, multiple sample panels may be required to finalize unit masonry selections to be used on the Project.
    b. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.
    c. Demolish and remove sample panels when directed by Architect.

G. Mockup Panels: Prior to installation of above grade unit masonry, allowing sufficient time for construction and approval, build mockup panels using materials and products indicated for the completed Work to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build mockup panels to include each type of unit masonry assembly in sizes of full assembly thickness by approximately 72-inches long by 72-inches high or larger to accommodate all necessary components.

1. Notify Architect seven days in advance of dates and times when mockups will be constructed.
2. Locate mockups in the location indicated or, if not indicated, as directed by Architect.
3. Provide masonry opening with installed aluminum window frame, steel lintel, sill and associated blocking, air-barrier and flashing as detailed on Drawings and as specified in this Section.
4. Include metal coping, roof edge fascia, gutters, thru-wall overflow roof scupper, and associated blocking and fasteners as detailed on Drawings and as specified in Division 7 Section “Sheet Metal Flashing and Trim.”
5. Omit portions of veneer, sill, coping, fascia, and aluminum frame in order to provide viewable *“cut-away”* areas and items of construction ordinarily hidden behind finished wall construction. Coordinate with Architect prior to Mockup Panel construction.
6. Build mockups for the following types of unit masonry assemblies in sizes required by full assembly thickness, including face veneer, cavity, backup and accessories. Include a sealant-filled vertical joint at least 16-inches long in each mockup.

    a. Exposed unit masonry veneer with unit masonry backup assembly.
    b. Exposed unit masonry veneer with metal stud backup assembly.
    c. Other assemblies incorporating unit masonry backup and claddings as specified in related sections including but not limited to, metal panel systems and exterior insulation finish system.
    d. Sealants as specified in Division 7 Section “Joint Sealants.

7. Clean exposed faces of mockups with masonry cleaner as indicated.
8. Protect accepted mockups from the elements with weather-resistant membrane.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

10. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; incorporation of specified and detailed products and accessories and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

11. Demolish and remove mockups only when directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting securely tied. If units become wet, do not install until they are dry.

1. Protect concrete masonry units from moisture absorption so that at the time of installation the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mixes on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.4 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24-inches down face next to unconstructed wythe and secure cover in place.

B. Do not apply uniform floor or roof loads for at least 12-hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come into contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surfaces.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 50 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning. Follow manufacturer's recommendations for minimum temperature.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48-inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide bullnose units for ALL INTERIOR outside corners unless otherwise noted.

B. Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (MPa).

2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to the following dimensions:

    a. 4 inches nominal; 3-5/8 inches actual.
    b. 6 inches nominal; 5-5/8 inches actual.
    c. 8 inches nominal; 7-5/8 inches actual.
    d. 10 inches nominal; 9-5/8 inches actual.
    e. 12 inches nominal; 11-5/8 inches actual.
    f. 14 inches nominal; 13-5/8 inches actual.
    g. 16 inches nominal; 15-5/8 inches actual.

4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

C. Decorative Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (MPa).
2. Weight Classification: Normal weight.
3. Size: Manufactured to dimensions indicated.
4. Finish: Exposed faces matching color, pattern, and texture of Architect's samples.

    a. Normal-weight aggregate, textured finish.

        1) Provide units made with aggregate matching aggregate in Architect's sample.

5. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen. Provide test results to Architect.

    a. Available Products: Subject to compliance with specified requirements, products that may be incorporated into the Work include, but are not limited to, the following:

        1) Block Plus W-10; Addiment Inc.
        2) Dry-Block; W. R. Grace & Co., Construction Products Division.
        3) Rheopel; Master Builders.

6. Field Applied Water Repellent: Where required by Decorative Concrete Masonry Unit manufacturer, provide field applied water repellent, subject to compliance with requirements of masonry manufacturer.

7. Color and Texture: As a minimum standard of quality, this specification is based on the products indicated below:

a. “Ethylene-Propylene-Diene-Monomer (EPDM) For all decorative concrete masonry units, Architect reserves the right to custom blend the final coloration of exposed aggregates.

8. 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) Anchor Oldcastle Company (formerly Trenwyth Industries, Inc.)
2) Nitterhouse Concrete Products, Inc.
3) Fizzano Bros. Concrete Products, Inc.
4) York Building Products, Inc.
5) Beavertown Block Co., Inc.

2.2 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: ASTM C216, Grade SW, Type FBS, and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
2. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C67.
3. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
4. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in the applied finish when viewed from 10 feet.
5. Size: Manufactured to the following actual dimensions:
   a. Modular Sized (New brick veneer and xisting Infills): Nominally 3-5/8-inches by 2-1/4-inches by 7-5/8-inches long.

6. Color and Texture: As a minimum standard of quality, this specification is based on the products indicated below. Architect reserves the right to revise and finalize all brick and mortar colors through the sample panel process.

    a. Brick Veneer to match existing adjacent school classroom wing (brick and mortar).
    b. Brick infill to match the adjacent existing veneer where the patch is located. This may require an additional 3 different brick colors.

7. Manufacturers: Subject to compliance with specified requirements, additional manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Glen-Gery Corp.
    b. Belden Brick.
    c. Watsontown Brick.
    d. Redland Brick, Inc.
    e. Endicott, Inc.
    f. General Shale, Inc.
    g. U. S. Brick

2.3 MORTAR AND GROUT MATERIALS

A. Available Products: Subject to compliance with specified requirements and suitability with specified materials as reviewed by the Architect, products that may be incorporated into the Work include, but are not limited to, the following:

1. Colored Portland Cement-Lime Mix:

    a. Eaglebond; Blue Circle Cement.
    b. Color Mortar Blend; Glen-Gery Corporation.
    c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
    d. Centurion Colorbond PL; Lafarge Corporation.
    e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
    f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

2. Mortar Pigments:

    a. True Tone Mortar Colors; Davis Colors.
    b. Centurion Pigments; Lafarge Corporation.
    c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

3. Water-Repellent Admixture:

    a. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
    b. Mortar Tite; Addiment Inc.
    c. Rheopel; Master Builders.

B. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C207, Type S.

E. Aggregate for Mortar: ASTM C144; except for joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

1. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C404.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer as that used in the concrete masonry units (Section 2.1.C.5.).

1. Provide integral water repellent admixture in mortar used for exposed decorative concrete masonry unit construction, including cavity wall construction.

I. Water: Potable.

2.4 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A615; Grade 60.

2.5 MASONRY JOINT REINFORCEMENT

A. General: ASTM A951 and as follows:

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
2. Wire Size for Side Rods: W1.7 or 0.148-inch diameter unless otherwise noted.
3. Wire Size for Cross Rods: W1.7 or 0.148-diameter unless otherwise noted.
4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16-inches o.c. Truss type shall not be used in vertically reinforced unit masonry walls.

C. For multi-wythe masonry, provide types as follows:

1. Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16-inches o.c. and with separate adjustable veneer ties engaging the cross ties. Crossties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 5/8-inch cover on outside face. Unless otherwise indicated, install in first and second courses above finished floor and in alternating back-up masonry courses thereafter.

    a. Use where indicated and where horizontal joints of facing wythe do not align (1-1/4-inches or less) with those of backup wythe.
    b. Use where facing wythe is of different material than backup wythe.
    c. Provide #270 Adjustable Ladder Eye-Wire Anchor System by Hohmann & Barnard, Inc., or equal product.

2. Adjustable (3-piece) type with ladder type reinforcement at back-up wythe which includes an extended cross rod. A vertical rod is hooked onto the extended cross rod and extends down to and behind the cross rod of the next lower truss type unit. An adjustable vee tie is hooked around the vertical rod for placement into the mortar joint of the face veneer.

    a. Use where indicated and where horizontal joints of facing wythe do not align (greater than 1-1/4-inches) with those of the back-up wythe.
    b. Provide Tie-HVR Anchor System by Hohmann & Barnard, Inc., or equal product.

2.6 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, and as required by Building Code Requirements for Masonry Structures; use of hot-dipped galvanized ties and anchors in exterior wall construction.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A153, Class B-2 coating.

C. Galvanized Steel Sheet: ASTM A653, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.

D. Steel Sheet, Galvanized after Fabrication: ASTM A366 cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153.

E. Steel Plates, Shapes, and Bars: ASTM A36. Plates, shapes, and bars exposed to weather shall be hot-dipped galvanized after fabrication.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME OR LINTELS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Crimped 1/4-inch diameter, hot-dip galvanized steel wire anchor section for welding to steel.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1-inch of masonry face, made from 0.25-inch diameter, hot-dip galvanized steel wire.

2.8 ANCHORS FOR CONNECTING TO SUBSTRATES

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. X-Seal® Veneer Anchors with VBT-Vee Byna-Tie by Hohmann & Barnard, Inc., or equal product.
2. X-Seal® Anchor shall be coordinated to details and/or conditions for the appropriate length to accommodate cavity width from face of rigid insulation to the masonry veneer and to include the appropriate connection interface to the anchor substrate, pronged legs to match insulation thickness so that prongs abut the steel studs, and/or at masonry the face of the substrates. Provide appropriate stainless steel self-drilling self-tapping screws and gasketed seal tape by Hohmann & Barnard, Inc., or equal product.
3. 2-Seal Byna-Lok Wire Tie shall be coordinated to details and conditions for metal stud wall construction for the appropriate length to accommodate cavity width from face of rigid insulation face to the masonry veneer and to include the insulation thickness and sheathing thickness so that the anchor barrel abuts the metal studs. The anchor barrel has a dual-barrel #12 self-drilling shaft with factory-installed EPDM washers to seal both the face of the insulation and the air barrier. The Byna-Lok Wire Tie is 9 gauge or 3/16-inch wire, anchors spaced at 16-inches x 16-inches directly into metal studs by Hohmann & Barnard, Inc., or equal product.
4. Veneer Anchors #345-SV at sill blocking and #345-BT at jamb blocking spaced and secured at 16-inches o.c. horizontally and vertically. Coordinate details and/or conditions for the appropriate length to accommodate cavity width from face of rigid insulation and/or wood blockings and/or concrete masonry back-up face to the masonry veneer and to include the appropriate connection interface to the anchor substrate. Provide appropriate stainless steel self-drilling self-tapping screws. Hohmann & Barnard, Inc., or equal product.

2.9 JOINT STABILIZATION ANCHORS

A. General: Provide stabilization anchors in horizontal joints of masonry units across the joint between walls at T-shape wall intersections as follows:

1. Use either a manufactured steel joint stabilizing anchor consisting of two steel rods, connected together on each side of masonry joint by sliding plate assemblies or 1-1/2-inch x 1/4-inch x 32-inch steel strap anchor with 3 inch (90 degree) right-angle bent ends at masonry shear walls.
2. Anchors to be embedded in grout-filled cores of hollow concrete masonry units.
3. 16-inches o.c. vertical spacing.
4. Finish: Mill galvanized or hot-dip galvanized to comply with ASTM A153.

2.10 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment through rigid insulation to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05-inch.

B. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

1. Anchor Section: Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs to penetrate insulation/sheathing and contact studs or concrete masonry unit face; and raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

a. Plate 1-1/4-inches wide by 6-inches long with strap 5/8-inch wide by 6-inches long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32-inch.
b. Provide anchor manufacturer's standard, self-adhering, gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating sheathing at pronged legs and screw holes.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Screw-Attached, Masonry-Veneer Anchors:

a. X-Seal with box tie with drip and X-Seal Tape, by Hohmann & Barnard, Inc., or equal product.

2.11 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Anchor Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
2. Non-headed bolts, bent in manner indicated.

C. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.

2. Type: Expansion anchors.
3. Type: Undercut anchors.
4. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
5. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.12 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabrications listed in this Section take precedence over materials specified in Division 7 Section “Sheet Metal Flashing and Trim. Fabricate from the following materials:

1. Fabricate through-wall metal flashing embedded in masonry from Type 304, 26 gauge (.018-inches thick) stainless steel formed to shape indicated.
2. Fabricate metal expansion-joint waterstops from Type 304, 26 gauge (.018-inches thick) stainless steel formed to shape indicated.
3. Fabricate stainless steel drip plates from Type 304, 26 gauge (.018-inches thick) stainless steel furnished with a smooth, factory-formed hemmed edge. Width: 3-inches.

B. Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. EPDM: Ethylene Propylene Diene Terpoymer synthetic rubber. Flexible 40 mil elastomeric rubber membrane. Minimum width as detailed.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:

1. Pre-fabricated Metal Flashing:

   a. Cheney Flashing; Cheney Flashing Company, Inc.
   b. Sandell

2. EPDM and Polypropylene Flexible Membrane Flashings:

   a. Carlisle Pre-Kleened EPDM; Carlisle Coatings & Waterproofing, Incorporated.
   b. Firestone Flashgard Thru-Wall Flashing; Firestone Building Products Co.
   c. H & B Textroflash (polypropylene) Thru-Wall Flashing; Hohmann & Barnard, Inc.

3. Single-Wythe Masonry Flashing: High-density polypropylene sloped continuous flashing pans with integral weep spouts, connector bridges, and included 90 percent open weave

polyester mesh drainage mats in each CMU core. System size to fit standard CMU widths; Block Flash by Mortar Net Solutions, or equal product.

2.13 MISCELLANEOUS MASONRY ACCESSORIES/MATERIALS

A. Available Products: Subject to compliance with requirements, materials that may be incorporated into the Work include the following:

1. For substitution products, refer to Division 1 Section “Substitutions” for procedures.

B. Compressible Expansion Material: Closed cell neoprene sponge with sensitive adhesive on one side ASTM D1056 Grade 2A1.

1. Products: Provide one of the following:

a. Hohmann & Barnard, Inc., NS-Neoprene Sponge
b. Dur-O-Wal, D/A 2015
c. Sandell Mfg. Co., Inc.

C. Compressible Exterior Expansion Joint Filler: Silicone faced acrylic-impregnated expanding foam sealant and closed-cell foam sealant system. ASTM E283-04, compressible up to 50 percent; of width and thickness indicated. Color as selected by Architect, from full range of standard and special colors.

1. Products: Provide the following:

a. Colorseal, Emseal Joint Systems, Ltd.

D. Preformed Control-Joint Gaskets: Styrene-Butadiene-Rubber Compound designed to fit standard sash block and to maintain lateral stability in masonry wall. ASTM D2000, Designation M2AA-805.

1. Products: Provide one of the following:

a. Hohmann & Barnard, Inc.
b. Dur-O-Wal
c. Sandell Mfg. Co., Inc.

E. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

F. Sill Weep: Weeps shall be installed as detailed at 16-inches o.c. on top of the metal drip plate along the length of the sill. Install per manufacturers written instructions.

1. Products: Basis of Design product, Hohmann & Barnard, Inc., 341 W/S Weep

a. Medium density polyethylene tested in conformance with ASTM D2244, D638 and D746.

b. 3/8-inch O.D. x 4-inch long with extended 4-inch wicks and brass or stainless-steel screen to match color of drip plate.
c. Lay extended wicks horizontally in opposite directions.

G. Cavity Drainage Material: Free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings. Use standard thickness products in compliance with manufacturer's gap tolerance between cavity substrate surfaces.

1. Products: Provide one of the following:

a. Mortar Net; Mortar Net USA, Ltd.
b. Mortar Trap, Hohmann & Barnard, Inc.

2. Full height cavity drainage material for use in insulated cavity walls is acceptable. Provide full height cavity drainage material in all non-insulated veneer masonry walls with minimal cavity space such as site walls.

a. CavClear Masonry Mat; CavClear, a Division of Archovations, inc.

H. Cavity Weep: Free-draining. Color as selected by Architect, from full range of standard and special colors. Provide one of the following:

1. Mortar Net Weep Vents, Mortar Net USA, Ltd.
2. Mortar Trap, Hohmann & Barnard, Inc.

a. Height of weep shall match height of the specified masonry veneer (up to 4-inches nominal) as indicated in Products. Use the 4-inch nominal height weep at 8-inches or higher masonry veneer units.
b. Color as selected to match associated mortar.
c. Made from polyester mesh.

3. Hohmann & Barnard, Inc., QV-Quadro-Vent

a. Polypropylene tested in conformance with ASTM D2240, D790B, D638 and D1238B.
b. Honeycomb design.
c. Color as selected to match associated mortar.
d. Size according to associated masonry veneer units.

I. Cavity Vent: Free-draining. Color as selected by Architect from full range of standard and special colors. Provide one of the following:

1. Mortar Net Weep Vents, Mortar Net USA, Ltd.
2. Mortar Trap Weep Vents, Hohmann & Barnard, Inc.

a. Height of weep shall match height of the specified masonry veneer (up to 4 inches nominal) as indicated in Products. Use the 4-inch nominal height weep at 8-inches or higher masonry veneer units.
b. Color as selected by Architect to match associated mortar.
c. Made from polyester mesh.

3. Hohmann & Barnard, Inc., QV-Quadro-Vent

    a. Polypropylene tested in conformance with ASTM D2240, D790B, D638 and D1238B.
    b. Honeycomb design.
    c. Color as selected to match associated mortar.
    d. Size according to associated masonry veneer units.

J. Stud Wall Cavity Wall Flashing Termination Bar: 304 stainless steel 1-inch x 1/8-inch x 8-foot long bar with foam-tite seal, bar punched to accept fasteners at 8 inches o.c., secure into each stud. Hohmann & Barnard, Inc. termination bar T2 with FTS Foam-Tite Seal, or equal product.

K. Cavity Air Barrier (Installed over C.M.U. above exterior grade): Continuous, single component, asphalt free, fluid applied, vapor permeable self-sealing elastomeric air barrier membrane that permits moisture vapor to escape through the membrane while remaining resistant to water and air penetration per ASTM E2178, ASTM E96 and ASTM E2357. Apply over C.M.U. at 60 square foot (25 mils wet) per gallon. Must be compatible with contacted surfaces and materials including cavity insulation.

1. Basis of Design Product: Enviro-Barrier VP™, Sandell Moisture Protection Systems; Hohmann & Barnard, Inc. Subject to compliance with specified requirements, the following products are also acceptable.

    a. Air Bloc 31MR – Manufactured by Henry Company
    b. Perm-A-Barrier VP – Manufactured by WR Grace
    c. Fire Resist Barritech VP – Manufactured by Carlisle Coatings & Waterproofing

L. Vapor Retarder (Installed over C.M.U. below exterior grade, at interior floor slab elevation changes, and where noted or detailed): Continuous, fluid applied, asphalt based non-fibered emulsion-type damp proofing which permits moisture vapor to escape through the membrane while remaining resistant to water and air penetration per ASTM D1187, ASTM D1227, E2178, ASTM E96, and ASTM E2357. Must be compatible with contacted surfaces and materials including cavity insulation.

1. Products: Subject to compliance with specified requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Karnak, 100AF Non-filtered Emulsion Damproofing, Karnak Corporation
    b. Sealmastic, Non-fibered Emulsion Damproofing, W.R. Meadow

M. Cavity Air Barrier (Installed over gypsum sheathing): Continuous, single component, asphalt free, fluid applied, vapor permeable self-sealing elastomeric air barrier membrane that permits moisture vapor to escape through the membrane while remaining resistant to water and air penetration per ASTM E2178, ASTM E96 and ASTM E2357. Apply over exterior gypsum sheathing at 75 square foot (20 mils wet) per gallon. Must be compatible with contacted surfaces and materials including cavity insulation.

1. Basis of Design Product: Enviro-Barrier VP™, Sandell Moisture Protection Systems; Hohmann & Barnard, Inc. Subject to compliance with specified requirements, the following products are also acceptable.

a. Air Bloc 31MR – Manufactured by Henry Company
b. Perm-A-Barrier VP – Manufactured by WR Grace
c. Fire Resist Barritech VP – Manufactured by Carlisle Coatings & Waterproofing

N. Cavity Air Barrier Accessories (Installed with C.M.U. and gypsum sheathing): For use in detailing transitions between dissimilar materials, cracks and voids, window and door openings, etc.

1. Products: Basis of Design products by Hohmann & Barnard include the following:

a. Enviro-Barrier™ Mastic, gun grade mastic; Sandell Moisture Protection Systems by Hohmann & Barnard, Inc.
b. Stretch-X-Seal Membrane, a flexible self-sealing adhesive backed with release liner, transition membrane flashing and sill tape; Sandell Moisture Protection Systems, by Hohmann & Barnard, Inc.
c. Spray-Tape™, a water based single component self-sealing spray or brush applied detail flashing for air barriers applied at 100 square foot (60 mils wet) per gallon, a minimum of 3-inches around the opening and a minimum of 3-inches into the opening; Sandell Moisture Protection Systems, by Hohmann & Barnard, Inc.

2. Subject to compliance with specified requirements, equal products by the following manufacturers are also acceptable.

a. Accessories manufactured by Henry Company
b. Accessories manufactured by WR Grace
c. Accessories manufactured by Carlisle Coatings & Waterproofing

O. Cavity Insulation (Installed over C.M.U.): Square edge extruded polystyrene insulation board, 16-inches x 96-inches, complying with ASTM C578, Type IV with a compressive strength of 25 psi. Install with manufacturer's standard board joint sealing system.

1. Products: Provide one of the following:

a. Foamular 250, Owens-Corning Co.
b. Cavitymate or Scoreboard, Dow Chemical Co.

P. Cavity Insulation (Installed over gypsum sheathing): Shiplap or tongue and groove edged extruded-polystyrene board, 48-inches x 96-inches, complying with ASTM C578, Type IV with a compressive strength 25 psi. Install with manufacturer's standard board joint sealing system.

1. Products: Provide one of the following:

a. Foamular 250, Owens-Corning Co.
b. Cavitymate SC, Dow Chemical Co.

Q. Insulation Inserts (Installed in cores of C.M.U. for single wythe masonry installations): Individually molded, expanded polystyrene inserts with a minimum density of 1.3 lbs./c.f., a thermal resistance of 5.0 per inch of thickness at 75 degrees, and complying with ASTM C578 Standard Type X. Insert into each C.M.U. core.

1. ICON Universal Inserts, as produced by Concrete Block Insulating Systems, Inc. or equal product.

R. Gypsum Sheathing: The below specified exterior gypsum sheathing for wall cavity assemblies takes precedence over any Division 6 specified products. Gypsum sheathing complying with ASTM C1177 and ASTM E84 with glass mats both sides and long edges, water-resistant treated core.

1. Dens-Glass Gold Sheathing, Georgia-Pacific.

2.14 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Follow brick manufacturer's recommendations for cleaning solution for each brick type.

1. Available Products: Subject to compliance with specified requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:

a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar and Not Subject to Bleaching:

1) 202 New Masonry Detergent; Diedrich Technologies, Inc.
2) Sure Klean No. 600 Detergent; ProSoCo, Inc.

b. Cleaners for Red and Dark-Colored Brick Not Subject to Metallic Staining:

1) 200 Lime Solv; Diedrich Technologies, Inc.
2) Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.

c. Cleaners for Brick Subject to Metallic Staining:

1) 202V Vana-Stop; Diedrich Technologies, Inc.
2) Sure Klean Vana Trol; ProSoCo, Inc.

2.15 MORTAR AND GROUT MIXES

A. General: Do not use calcium chloride. The use of admixtures shall not be considered unless their suitability is reviewed and approved by Architect and demonstrated by laboratory test results simulating the conditions that warrant the desired use of the admixture.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification.

1. Limit cementitious materials in mortar to portland cement and hydrated lime.
2. For masonry below grade, foundation walls, retaining walls in contact with earth, and where indicated, use Type M or Type S mortar, 1 part portland cement, 1/4 part Type S hydrated lime and 3-3/4 parts sand, with a minimum 28-day compressive strength of 2500 psi.
3. For above grade exterior brick and non-load bearing partitions use Type N mortar, 1 part portland cement, 1 part hydrated lime Type S and 6 parts sand.
4. For exterior above grade and load bearing clay brick and manufactured stone use Type S mortar.
5. For interior and exterior tuck pointing, use Type N mortar. For restoration work Contractor is required to review the properties of the existing masonry and submit the appropriate type mortar for approval.
6. For new brick veneer above grade use Type N mortar.
7. For natural stone masonry use Type M mortar.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:

1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
2. For carbon-black pigment and portland cement-lime mortar, not more than 2 percent.
3. For mineral-oxide pigments and mortar cement mortar, not more than 5 percent.
4. For carbon-black pigment and mortar cement mortar, not more than 1 percent.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry:

1. Use either pea gravel cement concrete or grout confirming with ASTM C476 with a minimum 28-day compressive strength of 3000 psi.
2. Provide grout with a slump of 8 to 11-inches as measured according to ASTM C143.

2.16 SOURCE QUALITY CONTROL

A. Brick Tests: For each type and grade of brick indicated, meet the requirements in the “Brick” Paragraph of this Section. Units will be tested according to ASTM C67.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, meet the requirements in the “Concrete Masonry Units” Paragraph of this Section. Units will be tested according to ASTM C140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Unit Masonry Assemblies shall be installed in accordance with Contract Documents, most recent technical standards published by the International Masonry Institute, the National Concrete Masonry Association, the Brick Industry Association and the product manufacturer's printed recommendations.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single wythe walls to the actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

G. Wetting of Clay Brick: Wet clay brick 3 to 24 hours before laying if the initial rate of absorption exceeds 20 g/30 sq. in. per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at the time of laying.

H. **NO CONDUIT OR PIPE SHALL BE INSTALLED VERTICALLY OR HORIZONTALLY IN THE CAVITY**. Penetrations through the cavity are permitted for items such as wall hydrants, electrical fixtures and devices, etc. but they shall be horizontal, perpendicular through cavity, and located directly at the intended item.

I. Install air barrier systems per manufacturer's printed instructions.

J. Install insulation board systems per manufacturer's printed instructions.

K. In lieu of field-formed flashing corners and end dams, preformed stainless steel corners and end dams may be used at Contractor's option. All products shall be compatible with the flashing system and shall be installed per the manufacturer's recommended printed instructions in addition to the sealing requirements described in the specification.

L. Install insulation per manufacturer's printed instructions.

M. Install single wythe masonry flashing per manufacturer's printed instructions.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances specified in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4-inch in 20 feet, nor 1/2-inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, nor 1/2-inch maximum.
3. For conspicuous horizontal lines such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4-inch in 20 feet, nor 1/2-inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than 1/8-inch with a maximum thickness limited to 1/2-inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
5. For exposed head joints, do not vary from thickness indicated by more than 1/8-inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joints in each course centered on units in courses above and below.

    a. One-half running bond pattern applies to all standard and painted CMU, to decorative CMU installations, and to modular brick infills where matching adjacent existing patterns.

2. One-third running bond with vertical joints in each third course aligning vertically.

    a. One-third running bond pattern applies to all utility sized brick installations.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Entire courses and/or individual units of irregular surface faced masonry (i.e., split face masonry units) shall be turned smooth side out in locations as directed by Architect during Preinstallation Conference.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof deck above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of deck above.
2. At fire-rated partitions, install firestopping in joint between top of partition and underside of deck above to comply with Division 7 Section “Through Penetration Firedstop Systems.”

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and compress into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Set stone trim units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone-joint surface thoroughly before setting; for soiled stone surfaces, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

D. Site Wall Copings (including cast stone and concrete): Set copings on canted stainless-steel flashing (drip plate flashing) with continuous hemmed drip edge at all faces of wall (length and ends). Install drip plate flashing on sloped mortar bed. Seal laps between lengths of drip plate flashing with lap sealant overlapped a minimum of 4-inches. Secure copings to wall with a kerfed split tail anchor mechanically attached to top of the wall. Set anchors on a membrane patch and fill anchor kerfs between coping pieces with sealant. Shim copings as required for level and alignment. Tool a 3/8-inch sealant joint between coping and the top of drip plate flashing below providing for weeps every 4-feet. Seal all skyward facing and vertical joints in coping material with joint sealant.

E. Sill Units (including cast stone, concrete and masonry): Tool skyward facing and vertical joints to a point 3/8-inches below the top face of the sill material. Apply a continuous sealant bead in the tooled joints. Sealant to match mortar color. At brick sills tool exposed joints to match adjacent joints. Tool joints between weeps.

F. Unless otherwise indicated, tool exposed joints slightly concave when thumbprint hard using a jointer larger than the joint thickness.

G. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with grout at exterior walls, except cavity walls, and solidly with mortar at interior walls and partitions.

3.6 BONDING OF MULTI-WYTHE MASONRY

A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints of back-up wall wythes facing cavities flush.

B. Installing Cavity-Wall Insulation: Apply rectangular grid adhesive on inside face of insulation boards. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Seal or tape all insulation board joints, crack and gaps, piping and conduit penetrations with materials compatible with insulation and masonry.
2. All insulation board joints and penetrations shall be sealed with manufacturers standard joint sealant systems to meet the air barrier requirements of ASTM E2357 Assembly test and the International Code Council (ICC-ES) Evaluation Report ESR-2142.

C. Wall Assembly for ASTM C578 polystyrene foam plastic insulation board shall meet the requirements of NFPA 285 Wall Assembly.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8-inch on exterior side of walls and 1/2-inch elsewhere. Lap reinforcement a minimum of 6-inches.

1. Space reinforcement not more than 16-inches o.c.
2. Space reinforcement not more than 8-inches o.c. at foundation walls and parapet walls.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

D. At all flashing locations, reinforcement shall not interrupt the flashing.

3.9 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Anchor masonry to structural members with flexible channel slot anchors embedded in masonry joints and attached to the structure. Provide a 1-inch space in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Space anchors at the location of the slotted channel anchor assembly on the structural member.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated, or if not indicated, in accordance with acceptable best practice procedures. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as detailed on Drawings or by one of the following approved methods:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces. **Maximum distance between C.M.U. control joints shall not exceed distances as indicated on Structural Drawings**.
2. Install preformed control-joint gaskets designed to fit sash block.
3. **Submit for approval a method as recommended by recent technical standards published by Industry standards as noted in Section 3.2.A above.**

C. Form building expansion joints in exterior masonry veneer as follows:

1. Form open joint of width indicated; install compressible exterior expansion joint filler as per manufacturers' recommendations. Keep joint free and clear of mortar. Install at locations indicated on Drawings.

D. Build in pressure-relieving expansion joints where indicated; construct joints by installing compressible expansion material.

3.11 LINTELS

A. Install lintels where indicated.

B. Provide lintels at all masonry wall openings greater than 12 inches wide. Refer to Structural drawings and Lintel Schedule.

3.12 FLASHING, WEEPS, AND VENTS

A. General: Install continuous embedded flashing and weeps in masonry at shelf angles, lintels, sills, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer. Adhere all flashing to steel angles.

C. Install flashing as follows:

1a. At thru-wall base flashing conditions and masonry relieving angles at composite masonry walls, including cavity walls, adhere a metal drip plate to the bedding joint of the outer

wythe of masonry with elastomeric sealant or manufacturer's approved bonding tape creating a 1/4-inch drip flange. Seal laps between lengths of the metal drip plate with lap sealant overlapped a minimum of 4-inches. Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the outer wythe of masonry (on top of the metal drip plate), back to the outer face of the inner wythe of masonry. Turn membrane flashing up a minimum of 16-inches behind the insulation, over the specified air barrier system, and extend into the inner wythe of masonry 1-1/2-inches. Seal laps between lengths of flashing with lap sealant overlapped a minimum of 4-inches. Provide positive drainage to weeps where bottom of flashing turns out to outer wythe of masonry. At masonry relieving angle conditions, install backer rod and sealant under the metal drip plate. Install transition membranes as required at all corners, obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

1b. At thru-wall base flashing conditions and masonry relieving angles at metal stud/masonry veneer walls, adhere a metal drip plate to the bedding joint of the veneer masonry with elastomeric sealant or manufacturer's approved bonding tape creating a 1/4-inch drip flange. Seal laps between lengths of the metal drip plate with lap sealant overlapped a minimum of 4-inches. Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the veneer masonry (on top of the metal drip plate), back to the face of the sheathing. Turn membrane flashing up a minimum of 16-inches behind the insulation, over the specified air barrier system and secure with a metal termination bar and continuous elastomeric sealant. Secure the termination bar into each metal stud. Seal the membrane flashing to the air barrier with the membrane manufacturer's compatible flashing tape. Seal laps between lengths of flashing with lap sealant overlapped a minimum of 4-inches. Provide positive drainage to weeps where bottom of flashing turns out to the veneer masonry. At masonry relieving angle conditions, install backer rod and sealant under the metal drip plate. Install transition membranes as required at all corners, obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

1c. At masonry opening sill flashing conditions (i.e. windows, etc.), adhere a metal drip plate to the bedding joint of the veneer masonry below the sill with elastomeric sealant or manufacturer's approved bonding tape creating a 1/4-inch drip flange. Seal laps between lengths of the metal drip plate (if any) with lap sealant overlapped a minimum of 4-inches. Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the veneer masonry (on top of the metal drip plate), turned up vertically then continuing horizontally below the window frame sill to meet the angle flashing stop. Flashing shall extend vertically in joint between window frame and vertical leg of angle flashing stop, terminating just below the top edge. Flashing shall be concealed below joint sealant. Seal laps between lengths of flashing (if and) with lap sealant overlapped a minimum of 4-inches. Extend flashing at sill ends and turn up not less than 2-inches to form a pan. Install air barrier behind the flashing. Provide positive drainage to weeps where bottom of flashing turns out to veneer masonry. At precast sills install weep material horizontally on top of the metal drip plate at 16-inches o.c. At brick sills install sill weeps vertically at 16 inches o.c. Center the weeps upon the length of the sill and tool the joints. At sill blocking provide Hohmann & Barnard, Inc. #345 SV and at jamb blocking provide Hohmann & Barnard, Inc. #345-BT veneer anchors as indicated on Drawings. Space and secure anchors horizontally and vertically at 16 inches o.c. Install transition membranes as required at all jambs and sills and at any obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

2. At lintels and shelf angles, adhere a metal drip plate with elastomeric sealant or manufacturer's approved bonding tape creating a 1/4-inch drip flange. Seal laps between lengths of the metal drip plate (if any) with lap sealant overlapped a minimum of 4-inches. Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the outer wythe of masonry (on top of the metal drip plate), back to the outer face of the inner wythe of masonry. Turn membrane flashing up a minimum of 16-inches behind the insulation, over the specified air barrier system, and extend into the inner wythe of masonry 1-1/2-inches. Extend EPDM flashing a minimum of 4-inches into the masonry at each end or to cover the full length of the lintel, whichever is greater. At heads and sills, extend flashing at ends and turn flashing up not less than 2-inches to form a pan. Seal laps between lengths of membrane flashing with lap sealant overlapped a minimum of 4-inches. Provide positive drainage to weeps where bottom of flashing turns out to outer wythe of masonry. At masonry relieving angle conditions, install backer rod and sealant under the metal drip plate. Install transition membranes as required at all corners, obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

3a. At low roof to high wall conditions at composite masonry walls, including cavity walls, adhere a two-piece interlocking type, 26-gauge stainless-steel sheet flashing to the bedding joint of the outer wythe of masonry with elastomeric sealant or manufacturer's approved bonding tape. The interlocking sheet flashing shall extend through the outer wythe of masonry. Seal laps between lengths of the metal sheet flashing with lap sealant overlapped a minimum of 6-inches. Turn the embedded metal sheet flashing up a minimum of 2-inches flush with the inner wythe of masonry to form a pan (behind the insulation). Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the outer wythe of masonry (on top of the metal sheet flashing), back to the outer face of the inner wythe of masonry. Turn membrane flashing up a minimum of 16-inches behind the insulation, over the specified air barrier system, and extend into the inner wythe of masonry 1-1/2-inches. Seal laps between lengths of flashing with lap sealant overlapped a minimum of 4-inches. Seal lap between stainless steel flashing and membrane flashing with elastomeric sealant. Install interlocking piece of flashing over roof termination as indicated on Drawings. Install transition membranes as required at all corners, obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

3b. At low roof to high wall conditions at metal stud/masonry veneer walls, adhere a two-piece interlocking type, 26-gauge stainless-steel sheet flashing to the bedding joint of the veneer masonry with elastomeric sealant or manufacturer's approved bonding tape. The interlocking sheet flashing shall extend through the outer face of the veneer masonry. Seal laps between lengths of the metal sheet flashing with lap sealant overlapped a minimum of 6-inches. Turn the embedded metal sheet flashing up a minimum of 2-inches flush with the sheathing to form a pan (behind the insulation). Extend EPDM (or other specified membrane) flashing from a point 1-inch in from the exterior face of the outer wythe of masonry (on top of the metal sheet flashing), back to the sheathing. Turn membrane flashing up a minimum of 16-inches behind the insulation, over the specified air barrier system and secure with a metal termination bar and continuous elastomeric sealant. Secure the termination bar into each metal stud. Seal the membrane flashing to the air barrier with the membrane manufacturer's compatible flashing tape. Seal laps between lengths of flashing with lap sealant overlapped a minimum of 4-inches. Seal the lap between stainless steel flashing and EPDM flashing with elastomeric sealant. Install

interlocking piece of flashing over roof termination as indicated on Drawings. Install transition membranes as required at all corners, obstructions and other interferences in the cavity to assure a continuous and watertight flashing system.

D. Install cavity weeps, cavity vents, sill sweeps and cavity drainage material in the head joints in exterior wythes of masonry as indicated on Drawings and as follows:

1. Space cavity weeps at minimum 24-inches o.c., 16-inches o.c. at 16-inches long masonry units.
2. Space cavity vents at minimum 48-inches o.c.
3. Install continuous sill weep material horizontally on top of flashing.
4. Place continuous cavity drainage material immediately above flashing in cavities.
5. Test weep with water poured into cavity to insure draining water freely comes out of each weep hole.

E. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

3.13 AIR BARRIER SYSTEM

A. Composite Masonry Walls and Cavity Walls: Apply cavity air barrier system on the entire exterior face of the inner wythe of masonry (behind the insulation board) to form a monolithic membrane on the cavity wall. Air barrier accessories and transition membranes shall be installed as detailed and/or required by system manufacturer over all dissimilar material transitions such as wood blocking, structural framing, cracks and voids, door and window openings and any other construction element that will prevent a continuous monolithic membrane. Follow manufacturers recommended installation procedures. System shall meet the requirements of the International Energy Conservation Code (IECC) ASTM E2357 Air Assembly Test.

B. Metal Stud Masonry Veneer Walls: Apply cavity air barrier system on the entire exterior face of the metal stud wall sheathing (behind the insulation board). Air-barrier accessories and transition membranes shall be installed as detailed and/or required by system manufacturer over all dissimilar material transitions such as wood blocking, structural framing, cracks and voids, door and window openings and any other construction element that will prevent a continuous monolithic membrane. Follow manufacturers recommended installation procedures. System shall meet the requirements of the International Energy Conservation Code (IECC) ASTM E2357 Air Assembly Test.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make the formwork sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and

support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.15 FIELD QUALITY CONTROL

A. Contractor shall engage a qualified independent testing agency to perform field quality-control testing indicated below.

B. Testing Frequency: Tests and Evaluations listed in this Article shall be performed during construction for each 35,000 bricks or 5,700 concrete masonry units Testing requirements for mortar and grout may be deleted if prism testing is retained.

C. Mortar properties shall be tested per ASTM C780.

D. Grout shall be sampled and tested for compressive strength per ASTM C1019.

E. Prism-Test Method: For each type of structural masonry wall construction indicated, masonry prisms shall be tested per ASTM C1314, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

F. Test weeps. Allow masonry 12-hours setting time before test. Test to be done in 10’ lengths of cavity.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

A. Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 047000 – ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Architectural precast concrete trims of the sizes, shapes and types indicated on Drawings.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, maintenance literature, product warranty information, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for architectural precast concrete units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For architectural precast concrete units.

D. Samples for Verification: For each color and texture of architectural precast concrete required, 10 inches square in size.

E. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of architectural precast concrete with ASTM C1364.

F. Material Test Reports: For each mix required to produce architectural precast concrete, based on testing according to ASTM C1364, including test for resistance to freezing and thawing.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of architectural precast concrete units similar to those indicated for Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Architectural Precast Association.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

C. Mockups: Furnish architectural precast concrete units for installation in mockups specified in Division 4 Section "Unit Masonry (Assemblies)".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of architectural precast concrete with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship architectural precast concrete units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining or wearing. Move architectural precast concrete units if required, using dollies with wood supports.
2. Store architectural precast concrete units on wood skids or pallets with non-staining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until architectural precast concrete has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

1.7 WARRANTY

A. Provide manufacturer's standard written warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Architectural Precast Concrete: Obtain architectural precast concrete units from single source from single manufacturer.

2.2 MATERIALS

A. General: Comply with ASTM C1364.

B. Portland Cement: ASTM C150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce architectural precast concrete color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33; gradation and colors as needed to produce required architectural precast concrete textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33, gradation and colors as needed to produce required architectural precast concrete textures and colors.

E. Color Pigment: ASTM C979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C260.
4. Water-Reducing Admixture: ASTM C494, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C494, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C494, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A615, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of architectural precast concrete material.

1. Epoxy Coating: ASTM A775.
2. Galvanized Coating: ASTM A767.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240, ASTM A276, or ASTM A666, Type 304.

2.3 ARCHITECTURAL PRECAST CONCRETE UNITS

A. Available Manufacturers: Basis of Design Product – Arban Precast Stone, LTD. for quality of finish and color, both base color and aggregates. www.arbanprecast.com 703-221-8005. Subject to compliance with requirements, other manufacturers that may be incorporated in the Work include, but are not limited to, the following:

1. Keystone Precast, Inc.
2. Advanced Architectural Stone; Advanced Cast Stone (Girard, PA plant).
3. Continental Cast Stone (West Berlin, NJ plant).
4. Corinthian Cast Stone, Inc.
5. Brentano's Cast Stone.
6. Faddis Concrete Products.
7. Reading Rock, Inc.
8. Frederick Block Brick & Stone.

B. Architectural Precast Concrete Units: Comply with ASTM C1364.

1. Units shall be manufactured using the wet-cast method.
2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C666, Procedure A, as modified by ASTM C1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than six days at mean daily temperature of 60 deg F or above.
c. No fewer than seven days at mean daily temperature of 50 deg F or above.
d. No fewer than eight days at mean daily temperature of 45 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures: As selected by Architect from manufacturer's full range. Provide units with fine-grained texture in colors as located on drawings. Colors to include buff color resembling smooth-finished or sand-rubbed Indiana limestone and gray color similar to gray ground faced concrete masonry veneer units.

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Division 4 Section "Unit Masonry (Assemblies)".

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240, ASTM A276, or ASTM A666.

B. Dowels: 1/2-inch-diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240, ASTM A276, or ASTM A666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by architectural precast concrete manufacturer and expressly approved by cleaner manufacturer for use on architectural precast concrete and adjacent masonry materials.

2.6 MORTAR MIXES

A. Comply with requirements in Division 4 Section "Unit Masonry (Assemblies)" for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING ARCHITECTURAL PRECAST CONCRETE IN MORTAR

A. Install architectural precast concrete units to comply with requirements in Division 4 Section "Unit Masonry (Assemblies)".

B. Set architectural precast concrete as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of architectural precast concrete with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 3/8 to 1/2 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Build concealed flashing into mortar joints as units are set.
5. Keep head joints in sills, copings and between other units with exposed horizontal surfaces open to receive sealant.
6. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to profiles and depths to match unit masonry assemblies, unless otherwise indicated by the Architect. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Where indicated, rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

I. Where indicated, point joints with sealant to comply with applicable requirements in Division 7 Section "Joint Sealants."

1. Prime architectural precast concrete surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at head joints of sills, copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime architectural precast concrete surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

K. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Architectural precast concrete may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in architectural precast concrete matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean architectural precast concrete as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed architectural precast concrete as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of architectural precast concrete.

3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean architectural precast concrete by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean architectural precast concrete with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 05 1200 - 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.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "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.

D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. LEED Submittals: Comply with Section 01 3329.
1. MR Credit 2: BPDO – Environmental Product Declarations
   a. For steel: Product-specific declaration or Industry-wide EPD or product-specific EPD.
2. MR Credit 3: BPDO – Sourcing of Raw Materials
   a. For recycled content steel: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
   b. For regionally sourced steel, if applicable: Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator 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. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.
7. Structural steel including chemical and physical properties.

F. Source quality-control reports.

G. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.

In the event the fabricator does not have AISC certifications, the company must provide evidence of a written quality control program which contains all elements addressed in the AISC certification standards; the company must be able to provide acceptable work references evidencing they have worked as a steel fabricator of good standing for five or more years; and the company must provide evidence of recently completed, previous work experience with Frederick County Public Schools delivering a comparable scope of work in size and sophistication.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. 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."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 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 Allowable Stress Design; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame, braced frame, and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, M-Shapes: ASTM A 36.

C. Plate and Bar: ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.

1. Weight Class: As required by design.
2. Finish: As indicated.

F. Steel Castings: ASTM A 216, Grade WCB with supplementary requirement S11.

G. Steel Forgings: ASTM A 668.

H. Welding Electrodes: Comply with AWS requirements.

I. Provide product-specific declaration or Industry-wide EPD or product-specific EPD. Include EPD Summary.

J. Recycled Content: Provide W-shape, channel and angle shapes steel with minimum 90 percent total recycled content including at least 60 percent post-consumer recycled content, except as follows:
1. Plate and Bar: Minimum 30 percent total recycled content.
2. Cold-Formed Hollow Structural Sections: Minimum 30 percent total recycled content.
3. Steel Pipe: Minimum 30 percent total recycled content.
4. All Other Steel Materials: Minimum 30 percent total recycled content.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: As indicated.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

E. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

G. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

A. Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting".

B. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.

C. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.

D. Primer: SSPC-Paint 23, latex primer.

E. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

F. Galvanizing Repair Paint: ASTM A 780.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to 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 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.

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 and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. 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.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

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.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1 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 are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include 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.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack 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 303, "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 are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
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 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: As indicated.

B. Weld Connections: Comply with AWS D1.1 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, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

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: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. LH- and DLH-series long-span steel joists.
4. Joist accessories.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

C. LEED Submittals: Comply with Section 01 3329.
1. MR Credit 2: BPDO – Environmental Product Declarations
    a. For steel: Product-specific declaration or Industry-wide EPD or product-specific EPD.
2. MR Credit 3: BPDO – Sourcing of Raw Materials
    a. For recycled content steel: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
    b. For regionally sourced steel, if applicable: Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

F. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications".

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications".

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:

a. Floor Joists: Vertical deflection of 1/240 (total load) of the span.

b. Roof Joists: Vertical deflection of 1/240 (total load) of the span.

2.2 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications".

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

H. Provide product-specific declaration or Industry-wide EPD or product-specific EPD. Include EPD Summary.

I. Recycled Content: Provide W-shape, channel and angle shapes steel with minimum 90 percent total recycled content including at least 60 percent post-consumer recycled content, except as follows:

1. Plate and Bar: Minimum 30 percent total recycled content.
2. Cold-Formed Hollow Structural Sections: Minimum 30 percent total recycled content.
3. Steel Pipe: Minimum 30 percent total recycled content.
4. All Other Steel Materials: Minimum 30 percent total recycled content.

2.3 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated.

1. Joist Type: LH-series steel joists and DLH-series steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: As indicated.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's "Specifications."

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

E. Recycled Content: Provide W-shape, channel and angle shapes steel with minimum 90 percent total recycled content including at least 60 percent post-consumer recycled content, except as follows:

1. Plate and Bar: Minimum 30 percent total recycled content.
2. Cold-Formed Hollow Structural Sections: Minimum 30 percent total recycled content.
3. Steel Pipe: Minimum 30 percent total recycled content.
4. All Other Steel Materials: Minimum 30 percent total recycled content.

2.4 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

B. Primer: Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.5 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Detail and fabricate according to SJI's "Specifications". Furnish additional erection bridging if required for stability.

C. Fabricate steel bearing plates from ASTM A 36 steel with integral anchorages of sizes and thicknesses indicated.

D. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

E. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

1. Finish: Plain, uncoated.

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

G. Welding Electrodes: Comply with AWS standards.

H. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

I. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting". Section 099600 "High-Performance Coatings".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications”, joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1.

1. In addition to visual inspection, test field welds according to AWS D1.1 and the following procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709.
c. Ultrasonic Testing: ASTM E 164.
d. Radiographic Testing: ASTM E 94.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting". Section 099600 "High-Performance Coatings".

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof deck.
2. Acoustical cellular roof deck.
3. Composite floor deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. LEED Submittals: Comply with Section 01 3329.
1. MR Credit 2: BPDO – Environmental Product Declarations
   a. For steel: Product-specific declaration or Industry-wide EPD or product-specific EPD.
2. MR Credit 3: BPDO – Sourcing of Raw Materials
   a. For recycled content steel: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
   b. For regionally sourced steel: Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Evaluation Reports: For steel deck, from ICC-ES.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard Gray.

2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G90 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G90 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard Gray.

4. Deck Profile: As indicated.
5. Profile Depth: As indicated.
6. Design Uncoated-Steel Thickness: As indicated.
7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
8. Span Condition: As indicated.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.
10. Provide product-specific declaration or Industry-wide EPD or product-specific EPD. Include EPD Summary.
11. Recycled Content: Provide steel with minimum 50 percent total recycled content including at least 25 percent post-consumer recycled content.
12. Regional Materials: If necessary to meet required LEED threshold, provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard Gray.

2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G90 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G90 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard Gray.

4. Deck Profile: As indicated.
5. Cellular Deck Profile: As indicated, with bottom plate.
6. Profile Depth: As indicated.
7. Design Uncoated-Steel Thickness: As indicated.
8. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
9. Span Condition: As indicated.
10. Side Laps: Overlapped or interlocking seam at Contractor's option.
11. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.
12. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

    a. Factory install sound-absorbing insulation into cells of cellular deck.

b. Installation of sound-absorbing insulation is specified.

13. Acoustical Performance: As indicated, tested according to ASTM C423.
14. Provide product-specific declaration or Industry-wide EPD or product-specific EPD. Include EPD Summary.
15. Recycled Content: Provide steel with minimum 50 percent total recycled content including at least 25 percent post-consumer recycled content.
16. Regional Materials: If necessary to meet required LEED threshold, provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

2.4 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 50 minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.
6. Span Condition: As indicated.
7. Provide product-specific declaration or Industry-wide EPD or product-specific EPD. Include EPD Summary.
8. Recycled Content: Provide steel with minimum 50 percent total recycled content including at least 25 percent post-consumer recycled content.
9. Regional Materials: If necessary to meet required LEED threshold, provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: As indicated.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: As indicated.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds as indicated.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor’s expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
3. Ceiling joist framing.
4. Soffit framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

D. LEED Submittals: Comply with Section 01 3329.
1. MR Credit 3: BPDO – Sourcing of Raw Materials
a. For recycled content steel: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
b. For regionally sourced steel: Documentation indicating locations of recovery, manufacture, purchase of recycled raw materials.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 (flexible finishes) or 1/600 (brittle finishes) of the wall height.

b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 for minimum uncoated steel thickness of 0.0428 inch and less; 50 for minimum uncoated steel thickness of 0.0538 inch and greater.
2. Coating: G60.
3. Recycled Content: Provide steel with at least 25 percent post-consumer recycled content.
4. Regional Materials: Provide steel manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: 1-5/8 inches, minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.

2. Inner Track: Of web depth indicated.

F. head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: 1-5/8 inches, minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.

2. Inner Track: Of web depth indicated.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: 1-5/8 inches, minimum.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: 1-5/8 inches, minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation

report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5, unless otherwise indicated.

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.
2. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing and/or infill studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.
2. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

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, but is not limited to the following items. Contractor shall thoroughly review and use both the Architectural and Structural drawings for details requiring miscellaneous metal fabrications that may be detailed throughout.

1. Loose bearing plates.
2. Loose steel lintels.
3. Steel framing and supports for operable partitions.
4. Steel angle framing for support of mechanical rooftop equipment.
5. Steel angle framing for support of roof openings at mechanical penetrations and roof hatches.
6. Miscellaneous steel angles and clip angles for support of lite-gauge metal framing.
7. Steel framing and supports for applications where framing and supports are not specified in other Sections.
8. Steel and other metal shapes, plates and bars for applications not specifically noted herein.
9. Metal fabrications detailed in the drawings and not specifically noted herein.
10. Elevator hoist beams.
11. Shelf angles.
12. Metal ladders.
13. Abrasive metal nosings.
14. Fasteners.
15. Miscellaneous materials.

B. Products furnished, but not installed under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 4 Section "Unit Masonry (Assemblies)" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 5 Section "Structural Steel Framing."
4. Division 9 Section “Painting” for primers and paint products.
5. Division 9 Section “High Performance Coatings” for primers.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Abrasive metal nosings.
2. Paint products. Also provide a copy to painter who will be applying paint topcoat.
3. Non-slip aggregates and non-slip aggregate surface finishes.
4. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide setting diagrams or templates for anchors and bolts which are to be embedded in concrete or masonry.

C. Samples for Verification: For each type and finish of abrasive metal nosing.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For professional engineer.

F. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

G. Welding certificates: Copies of certificates for field welding personnel must be available at Project site for review by Architect.

H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

I. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding Qualifications: Qualify procedures and personnel according to the following. Certify that welder has satisfactorily passed AWS qualification tests for welding processes involved.

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.2, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 DELIVERY AND COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Deliver fabrications to the Project site and store to avoid damage.

C. Identify pieces with suitable mark for easy location.

D. Deliver products in their original wrappings or carton clearly marked for identification and bearing manufacturer’s name, and model or part number, if applicable. Store to avoid damage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 Section "Quality Requirements," to design ladders and custom banner posts.

B. Structural Performance of Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36, except all wide flange shapes shall conform to ASTM A992/A572, Grade 50.

C. Steel Plates to be Bent or Cold Formed: ASTM A203.

D. Cold-finished Steel Bars: ASTM A108.

E. Checkered Plate: ASTM A786, rolled from plate complying with ASTM A500, or hot-rolled ASTM A283, Grade C or D.

F. Steel Tubing: Cold-form steel tubing complying with ASTM A500, or hot-rolled ASTM A501.

G. Steel Pipe: ASTM A53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads; welded or seamless; uncoated or hot-dipped galvanized as indicated on Contract Drawings.

H. Stainless-Steel Sheet, Strip, and Plate: ASTM A240 or ASTM A666, Type304.

I. Stainless-Steel Bars and Shapes: ASTM A276, Type304.

J. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

K. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

M. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.3 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D1187.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Metal: Factory-formulated galvanized metal primer for exterior application.

1. ICI Dulux Paints; 4160-XXXX Devguard Multi-purpose Tank and Structural Primer.
2. Kelly-Moore: 1722 Kel-Guard Acrylic Galvanized Iron Primer.
3. MAB Paints: Rust-O-Lastic Hydro-Prime II Acrylic (DTM) Maintenance Primer 073-189.
4. Pittsburgh Paints: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
5. Sherwin Williams: Galvite HS Paint B50WZ3.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A325, Type 3; with hex nuts, ASTM A563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

I. Plain Washers: Round, carbon steel, ASME B18.22.1.

J. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Concrete: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with primer specified in Division 9 Sections “Painting” and “High-Performance Coatings" where indicated.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, when members will be embedded in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with primer specified in Division 9 Section “Painting”.

2.9 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders: Engage a qualified professional engineer to design metal ladders, including connections to structure. Include effects of thermal movements.

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-3-inch steel flat bars, with eased edges.
3. Rungs: 1-inch diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
7. Galvanize and prime exterior ladders, including brackets.

2.10 ELEVATOR PIT SUMP COVERS

A. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 3/4 inch in least dimension.

B. Provide steel angle supports as indicated.

2.11 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast aluminum, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch lip, for casting into concrete.

B. Manufacturers: Subject to requirements, provide one of the following:

1. American Safety Tread
2. Balco, Inc.
3. Barry Pattern & Foundry
4. Safe-T-Metal Company

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with primer specified in Division 9 Section "Painting".

2.13 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with primer specified in Division 9 Section "Painting".

2.14 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standards listed below:

1. ASTM A123 for galvanizing steel and iron products.
2. ASTM A153 for galvanizing steel and iron hardware.

3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Division 9 Sections "Painting" and "High-Performance Coatings".

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

3.3 INSTALLING NOSINGS

A. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section “Painting".

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preassembled steel stairs with concrete-filled treads.

B. Related Sections:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 5 Section "Pipe and Tube Railings" for pipe and tube railings attached to metal stairs, and to walls adjacent to metal stairs.
3. Division 9 Section “Painting” for field finishing requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis, by a qualified professional engineer, licensed in the jurisdiction of the Project, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For qualified professional engineer who is legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs and railing systems similar to this Project in material, design, and extent and that have a record of successful in-service performance.

F. Welding certificates.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Fabricator of products.

C. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for classes of stairs designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.
2. Ornamental Stairs: Architectural class.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items

with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts, if indicated or required, with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Steel Tubing: ASTM A500 (cold-formed) or ASTM A513.

C. Rolled-Steel Floor Plate: ASTM A86, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

F. Galvanized-Steel Sheet: ASTM A653, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.

D. Machine Screws: ASME B18.6.3.

E. Lag Screws: ASME B18.2.1.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Primers: Provide primers that comply with Division 9 Section for “Painting”.

D. Universal Shop Primer: Fast-curing, lead and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

E. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

H. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3,000 psi unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

A. Manufacturing: Steel-framed stairs may be produced by a local or regional entity who specializes in structural steel or metal fabrications and who meets the quality assurance criteria indicated in this Section, or by a nationally-recognized manufacturer.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Alfab, Inc.
b. American Stair, Inc.

c. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers from steel tubes, as indicated.

a. Provide closures for exposed ends of stringers. Welds for end caps shall be flush and ground smooth for an architectural grade appearance.
b. Refer to details on Drawings for minimum tube sizes for stringers and platforms.

2. Construct platforms of tube headers as indicated and miscellaneous framing members as needed to comply with performance requirements or as indicated.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. If stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

a. Where gaps between stringers and masonry walls exceed 1/4-inch, provide minimum 1/8-inch-thick steel plate to conceal entire top edge of stringer, from end of radius to within 1/8-inch of wall, scribed to wall as necessary.

C. Metal-Pan Stairs: Form risers, sub-tread pans, and sub-platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold- or hot-rolled steel sheet, unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of sub-treads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Attach risers and sub-treads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. Shape metal pans to include nosing integral with riser.
5. At Contractor's option, provide stair assemblies with metal-pan sub-treads filled with reinforced concrete during fabrication.
6. Provide sub-platforms of configuration indicated or, if not indicated, the same as sub-treads. Weld sub-platforms to platform framing.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." Or SSPC-SP 3, "Power Tool Cleaning," as applicable.

E. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, non-shrink grout unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section “Painting”.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Architectural grade steel pipe and tube railing assemblies for stairs, ramps, mezzanines, balconies and at other conditions in which fall protection assemblies are required.
2. Railing and guardrail components.
3. Finishing requirements of architectural steel and tube railings.

B. Related Sections include the following:

1. Division 5 Section “Metal Fabrications” for wall ladders and alternating tread devices requiring railings.
2. Division 5 Section “Metal Stairs” for metal stairs requiring railings.
3. Division 6 Section “Rough Carpentry” for concealed wood blocking required for wall-mounted handrails and accessories.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.

2. Railing brackets.
3. Railing infill panels and accessories.
4. Grout, anchoring cement, and paint and coating products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples: For pipe, handrails, infill panels and trim, fittings and brackets. Samples need not be full height.

1. Provide samples of each exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For qualified professional engineer who is legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs and railing systems similar to this Project in material, design, and extent and that have a record of successful in-service performance.

F. Welding certificates.

G. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

I. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

J. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing railings similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. Welds shall be architectural quality, ground smooth for a finished appearance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect shop finishes on exposed surfaces from damage by applying a temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings: Provide railings and accessories based on the various standard-of-quality products indicated herein.

B. Source Limitations: Obtain each type of railing from a single source, and from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 Section "Quality Requirements," to design railings, including attachment to building construction and construction of the items specified in the Related Sections Article.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

A. Tubing: ASTM A500 (cold formed) or ASTM A513.

B. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for all exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36.

D. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.5 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Channels: ASTM B 221, Alloy 6063-T5/T52.

C. Plate and Sheet: ASTM B209, Alloy 6061-T6.

D. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

E. Castings: ASTM B26, Alloy A356.0-T6.

2.6 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153 or ASTM F2329 for zinc coating.
3. Conceal all fasteners to the greatest extent possible. Where fasteners must be exposed, match finish appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Powder Coating: Immediately after cleaning, apply two-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils for uncoated steel and 2 mils for metallic-coated steel. Comply with coating manufacturer's written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

E. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Finish Coats: All steel railing assembly components shall consist of a shop-applied powder-coated finish.

H. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

J. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

K. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.8 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop-assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:

1. As detailed on Drawings.
2. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
2. Install fire-retardant-treated wood blocking within cavities of metal stud framing as needed for anchoring brackets, as indicated in Division 6 Section “Rough Carpentry.”

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe, or other material as indicated, whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.9 RAILING COMPONENTS

A. Posts and Rails: Top, bottom and intermediate rails and vertical posts consisting of round steel tubing or Schedule 40 steel pipe, of dimensions and spacings indicated.

1. Finish: Shop-prime for powder-coated finish.

B. Infill Panels: Provide the following types, as indicated:

1. Balusters: Round steel tubing or Schedule 40 steel pipe, of dimensions indicated.
2. Woven-Wire Mesh: Cold-rolled, plain steel, 0.1200 inch thick square wire, complying with ASTM A510; 1-inch O.C. square pattern with an open area of approximately 80 percent.
    a. Finish: Plain steel shall be shop-prepared as necessary for powder-coated finish.
    b. Basis-of-Design Product: Provide product equal to McNichols Co. “Quality Square Weave Wire Mesh; HS Item No. 3692220048”.
    c. Orientation: Orient mesh with wires horizontal and vertical as detailed on Drawings.

3. Panel Edging for Woven-Wire Mesh Infill Panels: Hot-rolled, plain steel, 1-inch-wide, 18-gauge, U-shaped channel edging for enclosing and finishing the entire perimeter of each wire mesh panel. Opening width of edging shall accommodate thickness of wire mesh.

    a. Edging shall be friction-fit onto wire mesh panel and tack-welded into place. Adhere neoprene or similar material, of thickness required, to one or both sides of wire mesh panels to accommodate thickness of channel edge opening to provide a snug, rattle-free fit.
    b. Each corner of edging shall be precisely mitered, providing a hairline joint on all surfaces. Open joints shall be welded and ground smooth. Ease sharp corners and other edges by grinding or filing to a smooth finish.
    a. Finish: Plain steel shall be shop-prepared as necessary for powder-coated finish.
    b. Basis-of-Design Product: Provide product equal to McNichols Co. “Quality U Edging, Type 401; HS Item No. 4000040112.”

C. Wall-Mounted Handrail Brackets: Wall brackets and related accessories for steel or wood handrails; adequately sized to provide minimum clearance dimension between finished wall face and inside edge of handrail of 1-1/2 inches.

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide handrail brackets as manufactured by Julius Blum & Company, Inc. Other manufacturers who offer similar products that may be incorporated into the Work include, but are not limited to, the following:

    a. HDI Railing Systems, Inc.
    b. VIVA Architectural Hardware.
    c. Architectural Metal Works.
    d. Architectural Railings & Grilles, Inc.
    e. Atlantis Rail Systems; Division of Suncor Stainless.
    f. Blumcraft of Pittsburgh; Division of C.R. Laurence Co., Inc.

2. Brackets for Steel Pipe Handrails: Stamped steel brackets with curved top member for pipe rails, designed for welding or mechanically fastening rails.

    a. Finish: Shop-primed by manufacturer for powder-coated finish.
    b. Interior Handrail Brackets: Equal to Julius Blum & Co. “No. 622.”
    c. Exterior Handrail Brackets: Galvanized finish, equal to Julius Blum & Co. “No. 1622.”

3. Brackets for Wood Handrails: Cast aluminum brackets consisting of high-strength alloys suitable for clear anodizing; self-aligning type consisting of concealed mounting flange with threaded stud for securing bracket assembly at angle indicated or required; flat top with predrilled holes for mechanically fastening to handrail.

    a. Finish: Clear anodized with satin finish.
    b. Basis-of-Design Manufacturer: Equal to Julius Blum & Co. “Carlstadt; No. 443.”
    c. Stiffening Channels: Continuous extruded channels, of dimensions indicated, for stiffening and for mounting to brackets; to be mortised and mechanically fastened into bottom of wood handrails. Finish shall match handrail brackets.
    d. Wood Handrails: As indicated in Division 6 Section “Interior Architectural Woodwork.”

D. Railing-Mounted Handrail Brackets: Steel plate in dimensions and profiles indicated, with all exposed corners and edges rounded and ground smooth, free of sharp surfaces. Where wood handrails are required, provide continuous steel plate for mounting and stiffening, as indicated.

1. Finish: Shop-primed for powder-coated finish.

E. Supports, Brackets and Accessories: Form flanges, brackets, plates, stiffeners and other railing assembly mounting components from steel plate. Factory-drill weld holes and similar openings; grind surfaces smooth, free of burrs and sharp edges, and round corners to radii indicated.

1. Finish: Shop-primed for powder-coated finish.

F. Miscellaneous Accessories:

1. Throw-Bolts: Surface-mounted, required for joining various railing sections together; forged steel 8-inch-long by 3/4-inch-wide bolt throw with round bolt, slide brackets, and L-shaped universal strike; minimum throw distance of 1 inch; UL-listed.

    a. Finish: US10-B (Painted), factory-powder-coated or field-painted to match adjacent finish.
    b. Basis-of-Design Product: Equal to Rockwood Manufacturing Company; an ASSA ABLOY company “Item No. 580-8.”

2.10 STEEL AND IRON FINISHES

A. Galvanized Railings: For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123 for hot-dip galvanized railings.
3. Comply with ASTM A153 for hot-dip galvanized hardware.

4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Non-Galvanized Railings: For non-galvanized-steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Shop prime uncoated railings with universal shop primer and per the requirements indicated in Division 9 Section “Painting.”
2. Do not apply primer to galvanized surfaces.

F. Shop-Painted Finish: Provide all galvanized and nongalvanized railing assembly components with a shop-applied, powder-coated finish.

1. Color: As selected by Architect from manufacturer's full range.

2.11 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Except where posts are indicated to be perpendicular to stair stringers or similar construction, set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Unless specifically indicated to be non-welded connection, use fully-welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

1. Non-welded Connections: Only if specifically indicated, use mechanical joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Expansion Joints: Install expansion joints at locations indicated or required, but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Securing Posts to Metal Surfaces: Anchor posts to structural steel components, including steel tube stair stringers, by welding to brackets, flanges, angles, and similar components, or by welding bottom of post directly to structural steel. Provide bolted connections or other fastening means only where specifically detailed on Drawings.

1. Powder-Coated Shop Finishes: When possible, fabricate complete post assemblies by welding posts, brackets, flanges and similar components together, prior to powder coating to minimize disturbing final finishes. Only when necessary, grind off powder-coated finish from post or railing assemblies in order to adequately weld components to structural steel. Do not weld powder coating or other painted finishes.

B. Securing Posts to Concrete Slabs: Provide one of the following recessed post methods, as indicated:

1. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
2. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
3. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material; if welding connections are not required or feasible, attach to post with set screws. If cover flanges are not shown, leave anchorage joint exposed with 1/8-inch buildup, sloped away slightly from post.

3.5 ATTACHING RAILINGS

A. Anchor steel railing ends to posts by welding, unless otherwise indicated. Weld infill panel assemblies to posts and horizontal rails. Weld balusters to horizontal rails.

B. Install handrails in maximum practical lengths.

1. Steel Handrails: Neatly join ends of handrails of the same run together using sleeves set into each end of handrail a minimum of 2 inches. Weld seams and grind smooth.
2. Wood Handrails: Refer to Division 6 Section “Interior Architectural Woodwork.”

C. Attach handrails to walls or posts as indicated. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Where indicated or required, return handrails perpendicularly to walls, within 1/4 inch of finished wall surface.

1. For concrete and solid or grouted masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use the following attachment methods:

a. Between Studs: Use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
b. Stud Centers: Use self-tapping screws fastened to steel framing or to concealed steel reinforcements, or use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood sleepers.
4. Wood furring and grounds.
5. Sheathing.
6. Plywood backing panels.

B. Related Sections include the following:

1. Division 6 Section "Interior Architectural Woodwork" for nonstructural carpentry items exposed to view and not specified in another Section.
2. Division 9 Section “Wood Flooring” for wood flooring systems.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

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 - 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, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. 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.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, from ICC-ES showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

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. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, and plywood, and 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. 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.

D. Wood Structural Panels:

1. Plywood: Exterior grade where used as a backing material in exterior construction (CDX).
2. Oriented Strand Board: (OSB) APA-PRP-108.
3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
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. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. Where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels, behind finished wood veneer.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Furring.
5. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NELMA.
5. Northern species; NLGA.
6. Western woods; WCLIB or WWPA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD SHEATHING

A. Plywood Backing Panels

1. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

    a. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Preservative-Treated Plywood

1. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

    a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
3. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

C. Fire-Retardant-Treated Plywood

1. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
2. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

    a. Use treatment that does not promote corrosion of metal fasteners.
    b. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

c. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
d. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

3. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
4. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
5. Application: Treat plywood indicated on Drawings, including sheathing within 48 inches of fire walls.

2.7 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, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 MISCELLANEOUS MATERIALS

A. 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.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate, combined with an insecticide containing chloropyrifos as its active ingredient.

C. Sill-Sealer Gaskets: Closed-cell foam insulation, fabricated in strip form, for use as a sill sealer, 1/4–inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

D. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

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 WCD 1, "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. Install plywood backing panels by fastening to masonry; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

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 between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill below partitions.

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 AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

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.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

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 indicated 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 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 sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Custom plastic laminate cabinets and millwork.
2. Hardware and accessories for custom cabinets.

B. Related Requirements:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 8 Section “Flush Wood Doors” and “Sound Control Door Assemblies” for wood species and finishes related to interior architectural woodwork.
3. Division 9 Section "Painting" for shop-finishing requirements of interior architectural woodwork, including stains and transparent finishes.
4. Division 12 Section “Simulated Stone Fabrication” for solid-surface-material countertops and backsplashes.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each product indicated, including high-pressure decorative laminate and accessories, cabinet and millwork hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for grommets and other wire management components installed in architectural woodwork.
4. Show laminate panels with dimensions, seams, grain direction and exposed face.

C. Samples for Verification:

1. Plastic laminates.
2. Edging/banding materials.
3. Corner pieces as follows:

a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

4. Exposed cabinet hardware and accessories; one unit for each type and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product, signed by product manufacturer.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Installer who is either employed or approved by the Fabricator.

C. Quality Standard: AWI labeling and certification for fabrication is not required; however, as a standard of quality the Fabricator and Installer shall comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.11 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Products: Comply with the following:

1. Recycled Content of Medium-Density Fiberboard and Particleboard: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 20 percent.
2. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice

for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
4. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
5. Softwood Plywood: DOC PS 1, Medium Density Overlay.

B. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include:

    a. Formica Corporation.
    b. Nevamar Company, LLC; Decorative Products Div.
    c. Panolam Industries International Incorporated.
    d. Wilsonart International; Div. of Premark International, Inc.

2. Color: As selected by Architect from manufacturer’s full range of colors.

2.2 PLASTIC LAMINATE CABINETS AND MILLWORK

A. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Edges: PVC edge banding, matching laminate in color, pattern and finish.

    a. Cabinet Body Edges: 1mm thick.
    b. Door/Drawer Fronts: 3mm thick.

B. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

    a. Edges of Plastic-Laminate Shelves: PVC edge banding, 1mm thick, matching laminate in color, pattern, and finish.
    b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Hardwood plywood.
3. Drawer Bottoms: Hardwood plywood.

C. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

D. Door and Drawer Edging: Provide 3mm PVC edging for all doors and drawers on laminate custom cabinets/millwork.

1. Doellken – Woodtape, Inc.

a. Color: As selected by Architect from manufacturer's full range of colors.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range of colors including standard and premium laminates of solid colors, patterns and wood grains. Provide a minimum of (125) laminates.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware".

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 135 170 degrees of opening, self-closing.

D. Pulls: Doug Mockett, No. DP213B, Finish: Brushed Aluminum, Size: 7-7/8 inches.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
3. File Drawer Slides: Grade 1HD-100 and Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

L. Accessories: Equal to products manufactured by Doug Mockett & Company, Inc. Refer to Drawings for locations and types.

1. Grommets: For cable passage through countertops; 1-1/4-inch outside diameter, molded-plastic grommets and matching plastic caps with slot for wire passage. Equal to “OG Series.” Color: As selected from manufacturers full range.
2. Duplex Junction Box Grommet: Provide Doug Mockett, No. JB-2 at custom millwork access stations where necessary to access power & data outlets.
3. Wire Management Hangers: Equal to “Model No. WM2;” color to be determined.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Adhesives shall not contain urea formaldehyde.

D. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. VOC Limits for Installation Adhesives: Installation adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements. Provide any type of non-corrosive nail for exterior woodwork.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.6 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
4. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, grommets, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Where indicated, and whenever possible, install glass, plastic or metal panels, stand-offs, inlays, and similar decorative elements in the shop.

G. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.

1. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Nail-base polyisocyanurate board insulation.
4. Mineral-wool blanket.
5. Spray polyurethane foam insulation for use in miscellaneous voids.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry (Assemblies)" for insulation installed in cavity walls.
2. Division 7 Section “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing”, for insulation specified as part of roofing construction.
3. Division 7 Section “Through-Penetration Firestop Systems” for fire safing insulation.
4. Division 9 Section "Gypsum Board” for sound attenuation blankets.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E84.
2. Fire-Resistance Ratings: ASTM E119.

3. Combustion Characteristics: ASTM E136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Foam-Plastic Board Insulation: ASTM C578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

1. Thermal Properties: Minimum continuous R-Value of 5.0 per inch; 2-inch-thick shall be the equivalent of R-10.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The).
b. DiversiFoam Products.
c. Owens Corning.
d. Pactiv Corporation.

3. Foundation Insulation: Type IV, 25 psi; equal to Dow “Styrofoam SquareEdge.”
4. Cavity Wall Insulation: Refer to Division 4 Section “Unit Masonry (Assemblies)”.
5. Roofing Insulation: Refer to Division 7 Section “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing” for polyisocyanurate board insulation.
6. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET INSULATION

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. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Owens Corning.

B. Unfaced Glass-Fiber Blanket Insulation: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

C. Thermal Properties: Minimum continuous R-Value of 3.2 per inch; 6-inch-thick shall be the equivalent of R-19.

2.3 NAIL BASE POLYISOCYANURATE BOARD INSULATION

A. Nail-Base Polyisocyanurate Board Insulation: Class A thermal rigid insulation composed of closed cell polyisocyanurate foam bonded to 5/8" fire-retardant treated plywood. ASTM C1289, Type V made with Type II, Class 2 foam, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 250, respectively, per ASTM E84.

1. Compressive Strength: 25 psi minimum, complying with ASTM D1621.
2. Resistant to Mold: Passes (10), complying with ASTM D3273.
3. Water Absorption: Less than 0.1% volume; complying with ASTM C209.
4. Moisture Vapor Permeance: Less than 1.2 perms; complying with ASTM E96.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Basis of Design: Hunter Panels Xci
2. Carlisle Coatings and Waterproofing: R2+Base

C. Radius Installations: Contractor to score and cut panels as required to fit radius applications indicated. Boards shall be neatly fitted and butted together with small gaps sealed with spray-foam insulation.

D. Thermal Properties: Continuous R-Value of 6.44 per inch (average); 2-1/2-inch thick foam (3.1-inches overall with 5/8" plywood) for the equivalent of R-16.1.

2.4 MINERAL-WOOL BLANKETS

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. Roxul, Inc.
2. Industrial Insulation Group, LLC (IIG-LLC).
3. Thermafiber, Inc.; an Owens Corning company.

B. Mineral-Wool Blanket, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. For use in firestopping assemblies, as indicated.

2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

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. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

2.6 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit. Prepare panels for one of the following attachment methods.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, including at composite sheet waterproofing assemblies, set insulation units using manufacturer's recommended adhesive or loosely laid according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, as detailed on Drawings, and complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install where indicated on Drawings and in all voids and cavities in the building's thermal envelope formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the voids and cavities formed by framing members. If more than one length is required to fill the void or cavity, provide lengths that will produce a snug fit between ends.
2. Where indicated on Drawings, place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Set units in exterior walls with facing placed toward interior of construction.
    b. Set units in interior walls with facing placed toward areas of high humidity, unless otherwise indicated.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 074243 - COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Aluminum-faced composite panels.
2. Miscellaneous framing and fasteners.

B. Related Sections include the following:

1. Division 7 Section – Sheet Metal, Flashing and Trim for flashing and trim.
2. Division 7 Section - Joint Sealants for sealants and caulking.
3. Division 7 Section – Weather Barriers for weather barriers installed behind composite wall panels.
4. Division 7 Section – Thermal Insulation for rigid board insulation.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design system to accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to temperature and humidity ranges reasonably anticipated.
2. Design system to accommodate tolerances of structure.

B. Performance Requirements: Submit test data witnessed by an independent testing agency for the following:

1. Structural tests for wind loads by "Chamber Method" in compliance with ASTM E72.

a. Standard test design loading: 20 psf (960 Pa) positive and negative wind load.
b. Design panel system to withstand code-imposed design loads, and a deflection limit of L/180 shall apply to positive load pressures only.

2. Air Infiltration: 0.06 cfm per square foot (32 lps per square meter) air leakage under a static pressure of 1.56 psf (7.65 kg per square meter) when tested in accordance with ASTM E283.
3. Water Penetration: No uncontrolled water penetration through the standard vertical panel and sealed joints at a static pressure of 6.24 psf (30.5 kg per square meter) when

tested in accordance with ASTM E331.

1.4 SUBMITTALS

A. Submit under provisions of Division 1 Section – Submittals.

B. Product Data: Manufacturer's data sheets on each product used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit shop drawings showing layout, flashings, drainage, ventilation, vapor barriers, vapor retarders, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.

D. Initial Samples: For each finish product specified, two complete sets of color chips representing Manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 3-inches x 5-inches representing actual product, color, and patterns.

F. Quality Assurance Submittals: Submit the following:

1. Test reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Installer Qualifications:

1. Installer experienced in performing Work of this Section who has specialized in installation of Work similar to that required for the Project.
2. Panel Installer shall assume responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, Manufacturer's installation instructions, and Manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store panels horizontally, off the ground, in Manufacturer's unopened packaging until ready for installation.

B. Examine delivered materials upon receipt to ensure that no damage has occurred during shipment. Store metal-faced composite wall panels horizontally, covered with a suitable weather tight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with a positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. DO NOT allow storage space to exceed 120 deg. F.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.

1.8 WARRANTY

A. Finish Warranty: Warranty shall commence on Date of Substantial Completion.

1. Provide twenty (20) year written Warranty with PVDF fluoropolymer finish color coated metal finish covering color fading, chalking, and film integrity.
2. Finish coating shall not peel, blister, chip, crack or check.
3. Chalking, fading or erosion of finish measured by the following tests:

    a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D659.
    b. Finish coating shall not change color or fade in excess of 8 NBS units as determined by ASTM D2244.

B. Material and Installation Warranty: Warranty shall commence on Date of Substantial Completion.

1. Panels shall be warranted not to delaminate (separate) for a period of five (5) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Laminators Inc., Hatfield, PA 19440. T: (877) OMEGA77; www.laminatorsinc.com. Subject to compliance with specified requirements, equal products by other manufacturers are also acceptable.

B. Basis of Design Product: Omega-Lite Aluminum-Faced Composite Panels.

1. Panel Construction: Finished aluminum sheet over a corrugated polyallomer (CPA) core with backer sheet.
2. Panel Facing: Minimum 0.021-inch thick, smooth aluminum sheet complying with ASTM B209.
3. Panel Backing: Random coated aluminum sheet, minimum 0.013-inch thick, aluminum sheet complying with ASTM B209.
4. Panel Thickness: 6 mm (1/4 inch).
5. Fire Test Performance: ASTM E84, Class A.
6. Bond Test Performance: Passes ASTM C481-A Cyclic Aging.
7. Finish: Kynar 500 - PVDF fluoropolymer paint system meeting AAMA 2605.
8. Finish Colors: As selected by Architects from manufacturers full line of PVDF - Kynar finishes.
9. Aluminum Composite Wall Panel Installation System: One-Piece Tight-Fit Extrusion.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C645, cold-formed metallic-coated steel sheet, ASTM A653, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Base or Sill Angles Channels: 0.079-inch nominal thickness.

C. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements
2. Depth: As indicated.

D. Cold-Rolled Furring Channels: Minimum 1/2-inch wide flange.

1. Nominal Thickness: As required to meet performance requirements
2. Depth: As indicated
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
4. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch diameter

E. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 ACCESSORIES

A. Manufacturer's Sealants and Accessories: Provide manufacturer's recommended sealants and accessories for product installation.

B. Flashing: Fabricate flashing materials from 0.032 inch minimum thickness aluminum sheet painted to match composite wall panel system where exposed. Provide a 12-inch-wide lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-

hardening sealant.

C. Aluminum Extrusions: ASTM B221 alloy and temper recommended by Manufacturer for type of use and finish indicated.

D. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide Manufacturer's standard concealed fasteners.

2.4 FABRICATION

A. Panels shall be fabricated and finished as required to provide material construction and performance as specified and as required by Manufacturer to comply with warranty provisions.

1. Tolerances: Length and Width plus or minus 1/16-inch; squareness (diagonals) equal within 1/8-inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with substrate installer present for compliance with requirements for structural soundness, installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances listed below.

a. 1/4-inch in any 20 feet length vertically or horizontally.
b. 1/2-inch in any building elevation.

2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required.
3. Prepare written report endorsed by panel Installer and substrate installer, listing remedy for conditions detrimental to performance of the Work.

B. Examine roughing-in for components and systems penetrating metal composite wall panels to verify actual locations of penetrations relative to seam locations before metal composite wall panel installation.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with all Manufacturer's installation instructions, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation type

selected.

1. Install metal-faced composite wall panels according to orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and sub-girts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

    a. Commence metal-faced composite wall panel installation and install a minimum of 300 sq. ft. in the presence of a factory-authorized representative.
    b. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
    c. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed. Install flashing and trim as metal-faced composite wall panel work proceeds.

B. Work shall be done and completed in a thorough and workmanlike manner by mechanics skilled in their various trades.

C. Caulk Installation: Refer to Division 7 Section “Joint Sealants”.

    a. Use only approved sealants as described in manufacturers guidelines. Install sealant continuously between metal base channel (sill angle) and concrete and elsewhere is indicated or, if not indicated, as necessary for waterproofing.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.4 CLEANING AND PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

B. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose offsite.

C. Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Roof insulation.
3. Walkways.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof flashings and counter-flashings.
3. Division 7 Section "Roof Specialties" for roof hatches and other roof specialties.
4. Division 7 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Before starting roof deck construction, conduct conference at Project site in accordance with Division 1 Section “Project Meetings”.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing Installer, roofing system manufacturer's representative, deck Installer and other installers whose work interfaces with or affects roofing, including installers of roof drains, roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize the construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review deck substrate requirements for conditions and finishes, including flatness and fastening. At areas of new decking, examine decking surfaces prior to system installation for conformance to specified requirements.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.
10. Review warranty and manufacturer assembly letters.

1.5 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Details for base flashings and membrane terminations.
3. Flashing details at all roof penetrations.
4. Tapered insulation, thickness, and slopes including crickets and drain sumps.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
6. Tie-in with air barrier.

C. Samples for Verification: For the following products:

1. Roof membrane and flashings of color required.
2. Roof insulation.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

E. Qualification Data: For Installer and manufacturer.

F. Manufacturer Certificates:

1. Assembly Letter: Submit an “Assembly Letter” from the roofing manufacturer stating that their system, including all materials and components, meets the requirements of these specifications, including the specified Warranty.
2. Special Warranty Certificate: Signed by roof membrane manufacturer certifying that all materials supplied under this Section are acceptable for special warranty.

G. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

H. Evaluation Reports: For components of roofing system, from ICC-ES.

1. Provide fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

I. Field Quality Control Reports.

J. Sample Warranties: For manufacturer's special warranties.

1. Refer to Warranty Form attached to the end of this Section.

K. Maintenance Data: For roofing system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that specified for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty, with a minimum of five (5) years of experience installing the specified system.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation and other components of roofing system.
2. Warranty Period: 20-years from date of Substantial Completion.

a. Provide “No Dollar Limit” total system watertight Warranty.
b. Provide seventy-two (72) mile per hour windspeed Warranty.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashings, roof insulation, fasteners, and walkway products for the following warranty period:

1. Warranty Period: Two (2) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.

1. Accelerated Weathering: As tested by the manufacturer, roof membrane shall withstand a minimum of 2,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D4637, Type I, non-reinforced, EPDM sheet with factory-applied seam tape.

B. EPDM Roofing System Basis of Design: Carlisle Syntec Sure-Seal fully-adhered roofing system.

1. Subject to compliance with all specified requirements, other manufacturers offering products acceptable to the Work include, but are not limited to the following:

    a. Firestone Building Products Co.
    b. Versico Roofing Systems.
    c. Johns Manville.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.
4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

    1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard, aerosol-based spray adhesive.

E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 6-inch-wide, butyl splice tape with release film or factory-applied seam tape, width as recommended by manufacturer.

F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8-inch-thick; with anchors.

I. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.

B. Polyisocyanurate Board Insulation:

1. Basis of Design: Carlisle Syntec Systems; Carlisle Corp., SecurShield (coated glass facers)
2. Thermal Requirements: To obtain the required thermal envelope properties, the minimum long-term thermal resistance (LTTR) values shall be achieved, based on insulation board thickness.

    a. Minimum LTTR Values for Polyisocyanurate Board Insulation:

        1) 30.0 continuous or 30.0 average depending upon specific roof areas.
        2) Provide two (2) layers of 2.6-inch-thick polyisocyanurate insulation, utilizing staggered boards, for a total base thickness of 5.2 inches, not including tapered insulation. The specified 5.2-inch thickness is based upon Carlisle Syntec Systems SecurShield. Overall thickness may vary based upon manufacturer.

3. Compressive Strength: 20 psi and 25 psi.
4. Size: 48 by 96 inches or 48 by 48 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

    a. Roof Field: 1/4-inch per foot unless otherwise indicated on Drawings.
    b. Saddles, Sumps and Crickets: 1/2-inch per foot unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or two other insulation layer as follows:

1. Bead applied, low- rise, one-component or multi component urethane adhesive.

2.6 PAVERS

A. Concrete Pavers: Hanover Products or approved equal; 23-1/2-inches x 23-1/2-inches x 1-1/4-inches; 15 pounds per square foot, diamond finish, and natural color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Do not install insulation or roofing over damp, wet, frost covered or otherwise unsatisfactory deck conditions. Decking shall be clean and dry prior to proceeding with Work.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and not void warranty for existing roofing system.

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 6-inches in all directions.

    a. Ensure that decking is dry and frost free prior to proceeding with Work.
    b. Locate end joints over crests of decking.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4-inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump.

        1) Trim insulation so that water flow is unrestricted.

    f. Fill gaps exceeding 1/4-inch with foam insulation.
    g. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.
    h. Loosely lay base layer of insulation over substrate.

2. Install upper layer of insulation and tapered insulation with joints of each layer offset not less than 6-nches from previous layer of insulation.

    a. Install with long joints continuous and with end joints staggered not less than 6-inches in adjacent rows.
    b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    c. Make joints between adjacent insulation boards not more than 1/4-inch in width.
    d. At internal roof drains, slope insulation to create a square drain sump.
    e. Trim insulation so that water flow is unrestricted.
    f. Fill gaps exceeding 1/4-inch with foam insulation.
    g. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.
    h. Mechanically attach upper layer of insulation, through base layer and down to substrate as required to meet specified wind speed warranty.

3.5 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply aerosol adhesive spray to substrate and underside of roof membrane at rate required by manufacturer, and allow to 'flash-off' before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters as required to meet specified windspeed warranty.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

I. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

J. Spread water cut-off mastic bed over deck-drain flange at roof drains at a rate of one (1) tube per drain, and securely seal roof membrane in place with clamping ring.

3.6 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply aerosol spray adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply low-VOC EPDM primer, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars at a rate of 6-inches on-center or every pre-punched hole.

3.7 INSTALLATION OF WALKWAYS

A. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: Mechanicsburg Area School District
2. Street Address: 500 South Broad Street, Mechanicsburg, PA 17055
3. Building Name/Type: Mechanicsburg Area Senior High School
4. City/State: Mechanicsburg, Pennsylvania
5. Area of Work: Addition Roofs
6. Acceptance Date: _____
7. Warranty Period: Two (2) years from the date of Substantial Completion.
8. Expiration Date: _____

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Fire;
    c. Failure of roofing system substrate, including cracking, settlement, excessive Deflection, deterioration, and decomposition;
    d. Faulty construction of parapet walls, copings, chimneys, skylights, vents, Equipment supports, and other edge conditions and penetrations of the work;
    e. Vapor condensation on bottom of roofing; and
    f. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations,

attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exposed trim and fascia.
2. Metal flashing.
3. Copings.
4. Roof edge fascia.
5. Scuppers.
6. Gutters and downspouts.
7. Cast iron boots.
8. Precast concrete splash blocks.

B. Related Sections include the following:
1. Division 4 Section “Unit Masonry (Assemblies)” for mockup requirements to include sheet metal flashing and trim.
2. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 7 Section “Composite Wall Panels” for installing sheet metal flashing and trim integral with composite wall panels.
4. Division 7 Section “Standing Seam Metal Roofing” for metal roofing, flashings and trims associated with the metal roof.
5. Division 7 Section “Thermoplastic Polyolefin (TPO) Roofing” for sheet metal flashing and trim required to be used in conjunction with membrane roofing systems.
6. Division 7 Section “Joint Sealants” for elastomeric sealants to be installed in attachments, joints and penetrations of sheet metal flashing and trim.
7. Division 7 Section “Roof Accessories” for flashings required for various roof-penetrating items.
8. Division 21 Fire Protection Sections, Division 22 Plumbing Sections, Division 23 HVAC Sections and Division 26 Electrical Sections for various roof-mounted and penetrating items requiring sheet metal flashing and trim assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure

due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install flashings capable of resisting design forces according to recommendations in FMG Loss Prevention Data Sheet 1-49. Manufacture and install copings and roof edge flashings tested according to ANSI\SPRI ES-1 and capable of resisting design forces.

1. Refer to Structural Drawings for wind design criteria. At a minimum, design sheet metal flashings and trim to meet a 72 mph windspeed warranty.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes. For copings and roof edge flashings, allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.

1. Temperature Change (Range): 120 deg. F, ambient; 180 deg. F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

    a. Custom formed copings and roof edge flashings will be required for curved walls.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 1 foot.
10. Details of transitions between downspouts, cast iron boots and sub-surface storm drain systems.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Samples shall show the full range to be expected for each color required.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Copings, Roof Edge Flashings, Metal Closures, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

D. Qualification Data: For qualified fabricator.

E. Maintenance Data: For sheet metal flashing, trim and accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. The mockups required by this Section shall be installed as components of the full-scale masonry assemblies mockup specified in Division 4 Section “Unit Masonry (Assemblies)”.

1. Build mockups of typical roof conditions, including coping assembly, scupper box and/or conductor head, fascia, fascia trim, and/or apron flashing, including supporting construction cleats, seams, fasteners, attachments and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

D. Pre-installation Conference: Conduct conference at Project site in accordance with Division 1 Section “Project Meetings”.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Surface: Smooth, flat.
2. Exposed Finishes:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Color: As selected by Architect from manufacturer's full range of available two-coat colors.

b. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

C. Stainless-Steel Sheet: ASTM A240 or ASTM A666, Type 304, dead soft, fully annealed.

1. Finish: 2D dull, cold rolled (for installations not exposed to view).
2. Finish: 4 polished directional satin (for installations exposed to view).
3. Surface: Smooth, flat.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A153 or ASTM F2329 or Series 300 stainless steel.

C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

I. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene or polypropylene film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer in accordance with underlayment manufacturer's written instructions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
b. Henry Company.
c. Owens Corning.
d. SDP Advanced Polymer Products Inc.

J. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt; non-perforated.

K. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to the greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. On-Site Fabrication: Subject to compliance with specified requirements, sheet metal flashing and trim components, with the exception of copings, may be fabricated on-site or shop-fabricated using UL-certified roll-forming equipment if sheet metal flashing and trim components are of same profile and warranted by manufacturer to be equal to factory-formed components. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances of 1/4 inch in 20 feet on slope and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

J. Do not use graphite pencils to mark metal surfaces.

2.4 MANUFACTURERS

A. 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. Carlisle Syntec Systems.
2. ATAS International, Inc.
3. Cheney Flashing Company.
4. Hickman Company, W. P., an OMG, Inc. company.
5. Johns Manville.
6. Metal-Era, Inc.
7. Petersen Aluminum Corporation, a Carlisle company.
8. Una-Clad; Firestone Building Products.

2.5 ROOF-EDGE FASCIAS

A. Roof-Edge Fascia and Gravel Stop: Fabricate in minimum 96 inch-long, but not exceeding 12 foot-long sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to anchor the exterior leg.

1. Fascia Profile: As indicated on Drawings.
2. Joint Style: Butted with expansion space and 6 inch-wide, exposed cover plate.
3. Fascia Material: Aluminum, 0.050 inch thick.
4. Finish: Class 1 clear anodic finish.
5. Corners: Shop or factory-mitered ONLY.
6. Special Fabrications: Radiused Sections.

2.6 MISCELLANEOUS LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Counterflashing: Fabricate from aluminum, 0.032 inch thick.

B. Roof-Penetration Flashing: Fabricate from one of the following materials:

1. Copper: 16 oz./sq. ft.
2. Stainless Steel: 0.019 inch thick.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate one-piece welded scuppers to dimensions and details indicated on Drawings. Provide a 1-1/2-inch wide, one-piece picture frame trim at the exterior face of the building.

1. Scupper Material: Fabricated from 16 Ga. stainless steel as detailed.
2. Face Frame Material: One piece face frame fabricated from 16 Ga. stainless steel.

    a. Color: Provide powder coated finish on one piece face frame. Color as selected by Architect from full range of RAL color numbers.

B. Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop-fabricate interior and exterior corners.

1. Gutter Profile: Style A, according to cited sheet metal standard. Expansion Joints: Lap type or built in.
2. Accessories: Wire-ball downspout strainer; valley baffles, where applicable. Provide outlet tubes, end caps and other special pieces as required.
3. Material: Aluminum, 0.050 inch thick, Class 1 clear anodic finish. Metallic.

C. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with shop-fabricated, mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricated Hanger Style: Fig 1-35A, according to SMACNA's "Architectural Sheet Metal Manual." Material: Aluminum, 0.050 inch thick, Class 1 clear anodic finish.

2.8 CAST IRON BOOTS

A. Cast Iron Boots: Prefinished, gray iron castings complying with ASTM A48, contoured interior flow design with no boxed corners, weld seams or choke points. Include integral lug slots and side wall cleanout. Provide flexible rubber adaptor for connection to drainage pipe.

B. Basis of Design Products: J.R. Hoe & Sons, Middlesboro, KY www.downspoutboots.com.

1. Material: Cast iron.
2. Length: Minimum 28 inches with integral side wall cleanout.
3. Shape: Rectangular.
4. Offset Configuration: As required.
5. Opening Size: As required to receive downspout.
6. Finish: Powder coat. Color to be selected from manufacturer’s full range of available colors.

2.9 PRECAST CONCRETE SPLASH BLOCKS

A. Precast Concrete Splash Blocks: Precast concrete splash blocks with 3/16 inch radiused corners and 1/16-inch eased edges designed to channel water away from the base of the building.

B. Basis of Design Products: Modern Precast www.modernprecast.com.

1. Material: Concrete.
2. Length: 36 inches.
3. Width: 18 inches.
4. Thickness: 3-7/8 inches
5. Shape: Rectangular trough.
6. Color: Standard gray.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine walls, roof edges and parapets for suitable conditions.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof specialty and sheet metal flashing and trim systems.

1. Install roof specialties and sheet metal flashing and trim level, plumb and true to line and elevation with limited oil-canning. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats for securing sheet metal not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other, or where metals contact corrosive substrates such as pressure treated wood or cementitious construction, protect against galvanic action by one of the following methods:

1. Paint contact surfaces with bituminous coating or by other permanent separation coating as recommended by SMACNA.
2. Separate contact surfaces with felt (No. 30).
3. Separate contact surfaces with self-adhering sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of a corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4-inch for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

F. Rivets: Rivet joints in uncoated aluminum where indicated or where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA standards, and as detailed on Drawings. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet O.C. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

1. Calculate maximum storm water flows for roof areas to be drained by each gutter and size gutters to accommodate calculated flow volumes.

C. Downspouts: Join sections with 1-1/2 inch telescoping joints with upper sections inserted into lower sections. Provide fasteners designed to hold downspouts securely following the specified attachment Figure. Locate fasteners at top and bottom of downspout and at approximately 60 inches centers in between.

1. Provide elbows at base of downspouts to direct water away from building, or allow for connection into subsurface storm water system.
2. As a minimum size, calculate maximum storm water flows for the roof areas to be drained by each downspout and size downspouts to accommodate calculated flow volumes.
3. Install downspouts into cast iron boots. **PVC boots are not acceptable.**
4. Provide rubber boot transition caps at downspout boots to finish off the downspout to boot connection, and to prevent debris from entering the boot.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standards. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Fascias: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification. Refer to details on Drawings.

1. Install roof edge fascias in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Interlock exterior bottom edge of roof edge fascia with continuous cleat anchored to substrate at 24 inch centers.
3. All joints shall be weathertight.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standards unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 4 Section "Unit Masonry (Assemblies)".

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4-inch in 20 feet on slope and location lines as indicated, and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trims that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 ROOF SPECIALTIES (PRE-ENGINEERED CANOPY)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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 framing and hanger rods.
2. Metal roof panels.
3. Metal soffit deck.
4. Accessories.

1.3 COORDINATION

A. Coordinate sizes and locations of masonry bearing walls, anchor rod installation and masonry reinforcement requirements as specified in Section 042000 "Unit Masonry"

B. Coordinate with wall construction assemblies and thicknesses as indicated on the drawings.

C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Metal roof panels.
b. Metal soffit panels.
c. Metal Fascia and trim.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Wall Anchor Plans: Submit anchor plans and templates before masonry work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal canopy to masonry walls. Indicate reactions at each location.

2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches.

    a. Flashing and trim.
    b. Gutters.
    c. Downspouts.
    d. Service walkways.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For the following products:

1. Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.

E. Delegated-Design Submittal: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer certified in West Virginia responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer certified in the state of West Virginia. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.

4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel, fascia and trim assembly finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer who has manufactured similar pre-engineered pergolas for 10 years minimum.
1. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering Pre-Engineered Pergolas that may be incorporated in the Work include, but are not limited to, the following:

1. Basis of Design – Mapes Canopies, Lincoln, Nebraska, Tel. No. 1-888-273-1132.
    a. Model: Super Lumideck Hanger Rod Canopy System.

B. Source Limitations: Obtain metal canopy system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Materials:

1. Decking and fascia shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.

2. Decking Shall be 2 3/4" Extruded .078" Decking

3. Hanger rods and attachment hardware shall be powder coated to match canopy.

4. Fascia shall be standard 8" extruded "J" style (minimum .125 aluminum)Secondary-Frame Type: Manufacturer's standard purlins and flush-framed girts.

D. Finishes:

1. To be selected by the architect from the manufacturers full range of standard and optional colors and finishes.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pre-engineered canopy system system.

B. Structural Performance: Structural steel shall be detailed, fabricated and erected in accordance with the latest edition of the American Institute of Steel Construction (AISC) Manual.

1. Design Loads: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Structural Performance for Metal Roof Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

2.4 ACCESSORIES

A. General: Provide accessories as standard with canopy system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fascia, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, pre-painted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch (0.76-mm) nominal uncoated steel thickness, pre-painted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, pre-painted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

E. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, pre-painted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

2.5 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

C. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

D. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.6 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

    a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

    1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal canopy system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. 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 will be completed and in service.

E. Primary Framing: Erect framing level, plumb, rigid, secure, and true to line.

F. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

G. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions

cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

3.5 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof hatches.

B. Related Sections include the following:

1. Division 7 Section "Sheet Metal Flashing and Trim" for shop and field-formed metal flashing, roof-drainage systems and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally-induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant and field-assembled work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted or roof structure-mounted items, including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

D. Warranty: Sample of special warranty.

E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported or installed.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated, double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Babcock-Davis.
    b. Bilco Company (The).
    c. J. L. Industries, Inc. ; a division of the Activar Products Group.
    d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    e. Nystrom.

B. Type and Size: Single-leaf lid. Sizes as indicated on Drawings.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet, 0.090-inch thick; mill finish.

E. Construction:

1. Insulation: Cellulosic-fiber, Glass-fiber, or Polyisocyanurate board; R-Value of 12.0 or higher, according to ASTM C 1363.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.

F. Hardware: Stainless-steel spring latch with turn handles, butt or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches.

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube or aluminum.
4. Post: 1-5/8-inch-diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat; safety yellow color.

2.2 METAL MATERIALS

A. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Stainless-Steel Sheet and Shapes: ASTM A240 or ASTM A666, Type 304.

D. Steel Shapes: ASTM A36, hot-dip galvanized according to ASTM A123 unless otherwise indicated.

E. Steel Tube: ASTM A500, round tube.

F. Galvanized-Steel Tube: ASTM A500, round tube, hot-dip galvanized according to ASTM A123.

G. Steel Pipe: ASTM A53, galvanized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Clean off excess sealants.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Exterior sealants.
2. Exterior EIFS sealants.
3. Exterior and interior traffic sealants.
4. Interior sealants.
5. Interior food contact sealants.
6. Interior sanitary sealants.
7. Exterior and interior water immersed sealants.
8. Metal lap joint sealants.
9. Threshold and sheet metal bedding sealants.
10. Joint accessories.
11. Security sealants.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 7 Section "Through Penetration Firestop System" for building joint-sealant systems.
3. Division 8 Section "Glazing" for glazing sealants.
4. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
5. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 SUBMITTALS

A. Shop Drawing:

1. Submit a Sealant Schedule, and related details, indicating specific installation and interface between sealants and building materials for each type of joint sealant and joint backing material used in this specification. Use SAME reference designations as indicated in this Specification for preparation of the Joint Sealant Schedule in Part 3.6. Submittals are subject to the requirements of Division 1 Specification Section "Submittals."

B. Product Data:

1. For each joint-sealant product indicated.

C. Samples:

1. Submit standard cured color samples and charts for each sealant type illustrating full range of standard and custom colors.

D. Manufacturer's Certificate:

1. Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
2. For manufacturer's products that include the phrase, "but are not limited to the following," the Contractor shall be responsible to provide certification that the submittal product complies with the specified product. This certification is subject to the requirements of Division 1 Specification Section "Submittals," Part 1, Definitions.

E. Qualifications Data:

1. 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. Provide SWRI (Sealant, Waterproofing and Restoration Institute) Validation Certificate.

F. Compatibility and Adhesion from sealant manufacturer indicating the following:

1. Building materials forming joint and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
3. Preconstruction Compatibility and Adhesion Field Test for each sealant and building material.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit recommended inspection intervals.
2. Submit instructions for repairing and replacing failed sealed joints.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Provide SWRI (Sealant, Waterproofing and Restoration Institute) Validation Certificate.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 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 Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience for the following sealant types:

1. Multi-component sealants cure by chemical reaction. Cure times are predictable depending on atmospheric temperature. Silicone sealant cure is not affected by temperature, however, frost and moisture at bond line will impair adhesion.
2. Single component sealants cure by reaction with moisture. Cure times will vary depending on atmospheric humidity and temperature.
3. Fast cure (FC) sealants provide lesser cure times than corresponding standard cure products. Longer cure times will permit more accumulation of dust and other air-borne contamination on surface of sealant, potentially causing apparent color change.
4. Sealant Types are M – Multi-Component and S – Single Component.
5. Sealant Grades are P – Pourable or Self-Leveling used for horizontal traffic joints and NS – Non-Sag or Gunnable used for vertical and non-traffic joints.
6. Sealant Classes are 25, 50, and 100/50 (extension/compression) representing movement capability in percent of joint width. Joint movement is based on the relative percentage of installed width. Design to a minimum of 4 times anticipated movement to accommodate design tolerances and expected movement based on coefficient of thermal expansion.
7. Sealant Uses are T – Traffic, NT – Non-Traffic, I – Immersion, M – Mortar, A – Aluminum, and O – Other. Use O includes color anodized aluminum, metals other than aluminum, painted surfaces, brick, stone, tile, and wood for example.
8. Immersion rated sealant applications require primer.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of standard and custom colors.

2.2 URETHANE SEALANT TYPES – For exterior or interior use.

A. **U1** - Multi-Component, Non-Sag, Urethane: ASTM C920, Type M, Grade NS, Class 50; Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Pecora Corporation; Dynatrol II.
2. Polymeric Systems, Inc.; PSI-270.
3. Tremco, Inc.; Dymeric 240 FC.

B. **U2** - Multi-Component, Traffic-Grade Urethane: ASTM C920, Type M, Grade NS, Class 50; Uses T, Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Polymeric Systems, Inc.; PSI-270
2. Tremco, Inc.; Dymeric 240 FC.

C. **U3** - Single-Component, Non-Sag Urethane: ASTM C920, Type S, Grade NS, Class 100/50, Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Sika Corporation, Construction Products Division; Sikaflex-15LM.
2. Tremco, Inc.; Dymonic 100

D. **U4** - Single-Component, Non-Sag Urethane: ASTM C920, Type S, Grade NS, Class 25, Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Pecora Corporation; Dynatrol I-XL.
2. Sika Corporation, Construction Products Division; Sikaflex-1a.
3. Tremco, Inc.; Dymonic or Fulkem 116.

E. **U5** - Single-Component, Pourable, Traffic-Grade Urethane: ASTM C920, Type S, Grade P, Class 25, Uses T. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Pecora Corporation; Urexpan NR-201.
2. Tremco, Inc; Vulkem 45SSL.
3. Sika Corporation, Construction Products Division; Sikaflex-1CSL.

F. **U6** - Immersible, Single Component, Pourable, Traffic-Grade Urethane: ASTM C 920, Type S, Grade P, Class 25, Uses T and I. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Sika Corporation, Construction Products Division; Sikaflex-1CSL.
2. Tremco, Inc.; Vulkem 45 SSL.

G. **U7** - Immersible, Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920. Type M, Grade P, Class 25, for Use T and I. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. LymTal International, Inc.; Iso-Flex 880GB.
2. May National Associates, Inc.; Bondaflex PUR 2 SL.
3. Tremco, Inc.; Vulkem 245

2.3 SILICONE SEALANT TYPES – For exterior or interior use.

A. **S1** - Single-Component, Non-Staining, Non-Sag, Neutral-Curing Silicone: ASTM C920, Type S, Grade NS, Class 50, Uses NT. Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to the following:

1. Dow Corning Corporation; 756SMS, 791, 795 or 995.
2. Tremco, Inc.; Spectrem 3.
3. Pecora Corporation; 864, 895 or 898.

B. **S2** - Single Component, Non-Sag, Neutral-Curing Silicone: ASTM C920, Type S, Grade NS, Class 100/50, Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Dow Corning Corporation; 790
2. Pecora Corporation; 301NS, 311NS.
3. Tremco, Inc.; Spectrem 1.

C. **S3** - Single Component, Non-Sag, Neutral-Curing Silicone: ASTM C920, Type S, Grade NS, Class 50, Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Dow Corning Corporation; 791, 795 or 995.
2. Pecora Corporation; 864, 895 or 898.
3. Tremco, Inc.; Spectrem 2, Proglaze SSG.

D. **S-4** - Single Component, Field-Tintable, Non-Sag, Neutral-Curing Silicone: ASTM C920, Type S, Grade NS, Class 50, Uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Pecora Corporation; 890 FTS.
2. Tremco, Inc.; Spectrem 4TS.

E. **S5** - Mildew-resistant, Single Component, Acid-Curing Silicone: ASTM C920, Type S, Grade NS, Class 25, uses NT. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. BASF Building Systems; Omniplus
2. Dow Corning Corporation; 786 Mildew Resistant.
3. Tremco, Inc.; Tremsil 200 Sanitary.

2.4 LATEX SEALANT TYPES – For Interior Use Only

A. **L1** – Acrylic Latex or Siliconized Acrylic Latex, ASTM C834, Type OP, Grade NF. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. BASF Building Systems; Sonolac.
2. Pecora Corporation; AC-20+.
3. Tremco, Inc.; Tremflex 834.

B. **L2** - Acoustical Joint Sealant for Exposed and Concealed Joints: ASTM C1311 Manufacturer's standard Non-sag, paintable, no staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Tremco, Inc.; Acoustical Sealant.
2. Pecora Corporation; AC-20 FTR, AIS-919.
3. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 SOLVENT-RELEASE-CURING-JOINT SEALANTS:

A. **B1** - Butyl-Rubber-Based Joint Sealant: ASTM C 1311. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following.

1. Tremco, Inc.; Tremco Butyl Sealant.
2. Bostik, Inc.; Chem-Calk 300.
3. Pecora Corporation; BC-158.

2.6 PREFORMED JOINT SEALANTS – For exterior or interior applications per manufacturer's standards.

A. **PF1** - Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of procured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Dow Corning Corporation; 123 Silicone Seal
2. Pecora Corporation; Sil-Span
3. Tremco, Inc.; Simple Seal.

B. **PF2** - Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu.ft. (160 kg/cu.m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping. Subject to compliance with

requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Tremco, Inc.; illbruk illmod 600.
2. EMSEAL Joint Systems, Ltd.; Emseal 25V.
3. School International, Inc.; Sealtite, Sealtite 50N.

2.7 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASATM C 1330, of type indicated below and size and density to control sealant depth and otherwise contribute to producing optimum sealant performance, paired to the sealant type. List the type on the Sealant Schedule.

1. **Type C**: Closed-cell material with a surface skin.
2. **Type O**: Open-cell material.

    a. Bostik, Inc.
    b. Pecora Corporation
    c. Tremco, Inc.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant back materials, free of oil residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.9 EXISTING WORK

A. Mechanically remove existing sealant.

B. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface.

C. Allow joint surfaces to dry before installing new sealants.

2.10 SECURITY SEALANTS

A. At all Housing Modules (cells, dayrooms, secure areas, etc.), and in all areas accessible to inmates, install pick resistant correctional-complex type security sealant material at all locations, including around lighting fixtures (except where sealant will impede removal of fixture access covers), cover plates, embed plates (bunks, desks, stools, etc.), supply and return grilles and registers, mirrors, plumbing fixtures, control joints in walls and slabs, and at all areas where inmates have access to picking at or removal of caulking material. This includes all voids, gaps (including those between component assemblies) and joints larger than "hairline", are to be caulked with security sealant. List on the Sealant Schedule as Type **ESJS.**

1. Underside of precast planks (hollow-core slab units), which are to remain exposed and are 8 feet or less off finished floor, shall have joints between precast planks caulked with prison security joint sealant.

B. The use of prison security joint sealants shall take precedence over other specified sealant types, and this Joint Sealants Section shall take precedence over other technical specification sections that may contradict.

C. Joint filler material.

D. Security Joint Sealant: Epoxy Security Joint Sealant. Tamper and Abuse Resistant

1. 100% reactive, two component material specifically designed as a prison security sealant. Moisture insensitive, high modulus epoxy gel that can be applied on vertical, horizontal and overhead concrete member joints.

   a. In surfaces which do not get painted or otherwise finished, provide integral color products, or products where mixing of manufacturer's standard color packs will color the sealant material, i.e., gray in slabs on grade. In painted surfaces, standard white sealant is acceptable, to be painted with the adjacent surfaces.

E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include, but are not limited to, the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include, but are not limited to, the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead ¼ inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

Sealant types should be selected from the available listed products in Part 2 of this specification section. These sealants shall be indicated on the submittal schedule, using the same reference designation as indicated in Part 1.3.A. of this specification section.

A. Exterior or Interior Sealant Joints

1. Applications:

    a. Control and expansion joints in cast-in-place concrete.
    b. Joints between [architectural] [structural] precast concrete units.
    c. Control and expansion joints in unit masonry.
    d. Control and expansion joints in stone masonry.
    e. Butt joints between metal panels.
    f. Joints between different materials listed above.
    g. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
    h. Control and expansion joints in soffits and overhead surfaces.

2. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified

B. Interior Food Contact Sealant Joints.

1. Applications:

a. Joints in kitchen counter tops and work surfaces.
b. Joints between food service equipment and surrounding construction.
c. Other interior joints where incidental food contact may occur.

C. Interior Sanitary Sealant Joints.

1. Applications:

a. Joints in toilet room and bathroom counter tops.
b. Joints between plumbing fixtures and adjacent materials.
c. Joints between locker room lockers and adjacent materials.
d. Joints between food service equipment and surrounding construction.
e. Other interior joints in wet areas where needed to limit mold and mildew growth.

D. Immersed Sealant Joints.

1. Applications:

a. Joints in fountains and water features.
b. Joints in swimming pools.
c. Joints in vertical and horizontal surfaces of other potable water storage structures.

E. Metal Lap and Bedding Sealant Joints.

1. Applications:

a. Concealed lap and hook joints in sheet metal flashing and trim.
b. Bedding joints under metal thresholds and saddles.
c. Bedding joints between sheet metal flashing and other materials.

F. Preformed Joint Sealants:

1. Applications:

a. Control and expansion joints in cast-in-place concrete.
b. Joints between [architectural] [structural] precast concrete units.
c. Control and expansion joints in unit masonry.
d. Control and expansion joints in stone masonry.
e. Butt joints between metal panels.
f. Joints between different materials listed above.
g. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
h. Control and expansion joints in soffits and overhead surfaces.

i. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.
j. Joints between EIFS and other materials.

G. Interior Prison Security Sealants: **[EDIT PER PROJECT]**

1. Applications:

a. Control and expansion joints on exposed interior surfaces of floors, walls, etc., and at inmate/secure areas.
b. Perimeter joints on exposed interior surfaces of interior and exterior openings, i.e., window and door frames, etc.
c. Joints in precast walls, ceilings, and floor joints at inmate/secure areas.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, and similar openings, and at inmate/secure areas. Refer to Security Sealants paragraph above for additional information.
e. Other interior joints in vertical surfaces and non-traffic horizontal surfaces subject to movement for which no other sealant is specified, and at inmate/secure areas.
f. Joints between plumbing fixtures and adjacent materials at inmate/secure areas.
g. Joints between locker room lockers and adjacent materials at inmate/secure areas.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Factory primed, field painted steel doors.
2. Factory primed, field painted steel door frames.
3. Factory primed, field painted borrowed-lite frames.
4. Factory primed, field painted fire-rated door and frame assemblies.

B. Related Sections include the following:
1. Division 4 Section "Unit Masonry (Assemblies)" for building anchors into and grouting frames in masonry construction.
2. Division 8 Section “Flush Wood Doors” for wood doors that get installed in hollow metal frames.
3. Division 8 Section "Door Hardware" for door hardware and weather-stripping.
4. Division 8 Section “General Glazing” for glass in steel doors and sidelights.
5. Division 8 Section “Fire-Rated Glazing” for fire-rated glass in steel doors and sidelights.
6. Division 9 Section “Painting” for field painting primed doors and frames.
7. Divisions 26 through 28 Electrical Sections for power wiring and low voltage requirements for electrified hardware.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/ SDI A250.8.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site in accordance with Division 1 Section “Project Meetings”.

1. The Pre-installation Conference shall include representatives of the Owner’s technology department and security vendors. Prior to proceeding with the Work, the Contractor shall coordinate all equipment and rough-in requirements with these Owner vendors to ensure all required pathways, junction boxes, etc., are installed correctly.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Door hardware supplier shall furnish templates, template reference number and/or physical hardware to the steel door and frame supplier to prepare the doors and frames to receive the finish hardware items.

D. Shop Drawings: Include the following:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
2. Elevations of each door design.
3. Details of doors, including vertical and horizontal edge details and metal thicknesses.
4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Locations of reinforcement and preparations for hardware.
6. Details of each different wall opening condition.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.
10. Details of conduit and preparations for power, signal, and control systems. **Include point-to-point wiring diagrams showing the following:**

    a. Power requirements for each electrically operated door hardware component.
    b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

E. Door Schedule: Submit schedule of doors and frames using **SAME** reference numbers for details and openings as those on Contract Documents.

1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.6 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 “Recommended Specifications for Standard Steel Doors and Frames” and as specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E152, and are labeled and

listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg. F maximum in 30 minutes of fire exposure.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

1.8 COORDINATION

A. Field Measurements: Verify actual dimensions of openings by field measurement before fabrication.

B. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete and masonry inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

C. Coordinate requirements for installation of electrified door hardware, access control and security systems.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain hollow doors and frames from a single source, from a single manufacturer.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steelcraft; an Allegion company.
2. Amweld Building Products, LLC.
3. CECO Door Products; an ASSA ABLOY Group company.
4. Curries Company; an ASSA ABLOY Group company.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg. F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

2.3 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A569.

B. Cold-Rolled Steel Sheet: Carbon steel complying with ASTM A366, commercial quality, or ASTM A620, drawing quality, special killed.

C. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A591, Commercial Steel (CS), 4oz coating designation; mill phosphatized. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A153, Class C or D as applicable.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: 1-3/4-inch flush panel; full flush door edges with continuous laser weld.

    a. Provide undercuts as noted on the Door Schedule.

2. Core Construction: As follows:

    a. Standard Interior Doors: Manufacturer's standard honeycomb core.
    b. Fire Doors: Manufacturer's standard core as required to provide fire-protection and temperature-rise ratings indicated.
    c. Exterior Doors: 1.8 lb/cu. ft. density polyurethane core, laminated to both face sheets with contact adhesive; capable of carrying the following minimum thermal-resistance properties:

        1) ASTM C518, Calculated: 10.0 R-Value; 0.10 U-Factor.
        2) ASTM C1363, Operable: 2.9 R-Value; 0.35 U-Factor.

3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth.

    a. Vertical Edges for Single-Acting Doors: Beveled edge; 1/8 inch in 2 inches.
    b. Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.

4. Top and Bottom Edges: Closed with inverted 15-gauge-thick minimum end closures or channels of same material as face sheets, extending full width of the door and welded to face sheet.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Extra heavy-duty, Level 3, Model 2, seamless design, minimum 0.053-inch thick (16 Ga.) galvanized steel sheet faces.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Heavy-duty, Level 2, Model 2, seamless design, minimum 0.042-inch-thick (18 Ga.) cold-rolled steel sheet faces Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

a. At interior locations noted to be galvanized, provide extra heavy-duty, Level 3, Model 2 doors.

D. Hinge Reinforcement: Minimum 7 gauge plate, 1-1/4 inch x 9 inches, or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated (galvanized) steel sheet.

1. Fabricate frames with mitered or coped corners, face-welded unless otherwise indicated.
2. Frames for Level 3 Steel Doors: 16-gauge-thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet; provide metallic-coated steel sheet where specifically indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face-welded, unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.

a. Frames with sidelites in drywall installations shall be welded.

4. Frames for Level 2 and Level 3 Steel Doors, Wood Doors and Borrowed Lights: 16-gauge-thick steel sheet.

    a. Fabricate interior frames from metallic-coated steel sheet where doors are noted to be galvanized in the Door Schedule.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

E. Plaster Guards: Provide minimum 0.0179-inch-thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

F. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry (Assemblies)."

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 19 gauge thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 7 gauge thick.
2. Stud-Wall Type: Designed to engage steel stud, welded to back of frames; not less than 19 gauge thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Provided at each jamb, formed from A60 metallic-coated material, minimum 19-gauge-thick.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 22-gauge-thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 22-gauge-thick, fabricated from same material as frames in which they are installed.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, minimum 8-gauge-thick.

C. Metal Louvers: Door and frame manufacturer's standard metal louvers, unless otherwise indicated. Provide louvers where noted in the Door Schedule.

1. Blade Type: Vision proof, inverted V or Y shape.
2. Metal and Finish: Galvanized steel, minimum 20-gauge-thick, factory-primed for factory-painted, powder-coated finish. Match pre-finished door and frame paint color, where applicable.
3. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 90 minutes and less; meet fire rating as indicated.

2.9 FABRICATION

A. Fabricate hollow metal doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory-cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.

2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware. Provide minimum 14-gauge closer reinforcement.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections.

G. Electrified Hardware Coordination: Factory-weld 18 gauge electrical knockout boxes to frame for electrical hardware preparation, including, but not limited to, through-wire transfer hardware, raceways and wiring harnesses, door position switches, electric strikes, magnetic locks and jamb-mounted card readers, as specified in the hardware sets in Division 8 Section “Door Hardware” and Division 26 through 28 Electrical Sections.

1. Provide electrical knockout boxes with dual 1/2-inch and 3/4-inch knockouts.
2. Conduit shall be coordinated and installed in the field from middle hinge box and strike box, and strike box to door position box.
3. Electrical knockout boxes shall comply with NFPA requirements and accommodate electrical door hardware, per door hardware set requirements.

4. Electrical knockout boxes for continuous hinges shall be located in the center of vertical dimension on hinge jamb.

H. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
6. Glazing: Comply with requirements in Division 8 Sections “General Glazing” and “Fire-Rated Glazing” and with hollow metal door manufacturer’s written instructions.

2.10 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual” for recommendations relative to applying and designating finishes.

B. Comply with SSPC-PA-1, “Paint Application Specification No. 1,” for steel sheet finishes.

C. Apply primers and organic finishes to doors and frames after fabrication.

2.11 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.

1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

2.12 STEEL SHEET FINISHES

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP-8 (Pickling).

B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.

C. Factory Priming for Field-Painted Finish: Apply shop primer that compiles with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Contractor shall verify the accuracy of all dimensions indicated for existing openings in which new hollow metal frames and doors are scheduled to be installed, as well as existing frames scheduled to remain and accommodate new doors and/or hardware. Verify existing frame conditions to include, but not be limited to, locations of strikes and hinges and hinge backsets, for new hardware provisions.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field-apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. In-Place Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 8 Sections "General Glazing" and “Fire-Rated Glazing” and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly, between 2 inches o.c. and 9 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections include the following:

1. Division 8 Section “Door Hardware” for door hardware requirements.
2. Division 8 Section “General Glazing” for glass view panels in flush wood doors.
3. Division 8 Section “Fire-Rated Glazing” for glass view panels in fire-rated flush wood doors.
4. Division 8 Section “Hollow Metal Doors and Frames” for metal frames for wood doors.
5. Divisions 26 through 28 Electrical Sections for power wiring and low voltage requirements for electrified hardware.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications**.**

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Details of doors, including vertical and horizontal edge details.
3. Indicate dimensions and locations of cutouts.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.
6. Indicate preparations for power, signal, and control systems.

C. Door Schedule: Use **SAME** reference designations indicated on Drawings in preparing schedule for doors and frames.

D. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with WDMA Architectural Woodwork Quality Standards Illustrated.

1. Provide WDMA Quality Certification Labels or a WDMA letter of licensing for Project indicating that doors comply with requirements of grades specified.
2. When requested, provide evidence that the installer has successful experience completing projects of similar scope and with products as specified herein.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist), or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Basis of Design Product – Marshfield Algoma Aspiro Series by Masonite Architectural Subject to compliance with all specified requirements, the following manufacturers' products may also be incorporated into the Work:

1. Flush Wood Doors:

a. VT Industries/Eggers.
b. Lambton.

B. Manufacturers other than those listed above will not be accepted – No substitutions will be allowed.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Premium, with Grade A faces.
2. Species and Cut: Oak, plain sliced.
3. Veneer flitch match: Book match, running match.
4. Pair Match: Provide for doors hung in same opening or separated only by mullions.
5. Stiles: Same species as faces.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2, 32 lb. density.
2. Blocking: Provide solid wood blocking in particleboard-core doors for installation of hardware.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed and then veneered or laminated in a one-step hot press method.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated for installation of hardware.

    a. Doors with exit devices provide top rail, bottom rail and 5 x 10 right and left lock blocks.

3. Edge Construction: At hinge stiles, provide manufacturer's standard veneer-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

    a. At locations where new doors are being retrofitted into existing frames, provide lumber edge doors to all for minor field fitting.

4. Pairs: Furnish formed-steel edges and astragals with intumescent seals for pairs of fire-rated doors, unless otherwise indicated.

    a. Finish steel edges and astragals with baked enamel.

5. Pairs with Surface Mounted Panic Devices: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.
6. Intumescent Seals For Fire Rated Doors: Category “A” doors with manufacturer’s standard concealed intumescent seals.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

C. Metal Louvers: Where doors are indicated in the Door Schedule to receive louvers, provide the following:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Louvers, Inc.; a division of the Activar Construction Products Group.
    b. Anemostat Products; a Mestek company.
    c. L & L Louvers, Inc.
    d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
    e. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted Y or V.
3. Metal and Finish: Cold-rolled steel, 18-gauge frames with 22-gauge blades, factory-finished. Color to be selected by Architect from manufacturer's full range of available colors.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

    1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

    1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
    2. Metal Astragals: Pre-machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

    1. Light and Louver Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

A. General: Comply with WDMA Architectural Woodwork Quality Standards Illustrated for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:

    1. Grade: Premium.

2. Finish: WDMA System TR-6 catalyzed polyurethane, or UV cured polyurethane.
3. Staining: To be selected by Architect from manufacturer's full range of stain colors.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects, and replace at no cost to Owner.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083300 - OVERHEAD COILING DOORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Division 0 - Bidding and Contract Requirements and Division 1 General Requirements apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of overhead coiling doors:

1. Electric Operated Steel Coiling Service Doors

B. Related Sections include the following:

1. Division 5 Section “Metal Fabrications” for miscellaneous steel supports.
2. Division 8 Section "Coiling Counter Doors" counter door at dish return.
3. Division 8 Section "Door Hardware" for lock cylinders and keying.

1.3 DEFINITIONS

A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 10,000 cycles.

1.5 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from the overhead coiling door manufacturer.

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. Clopay Building Products Company, Inc.
2. Wayne-Dalton Corp.
3. Cornell Door Company
4. Raynor.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Galvanized Steel Curtain Slats (for electrically operated coiling service doors): No. 5F, minimum 20 gauge. Grade 40 steel, ASTM A653 galvanized steel zinc coating with Bottom Bar: Extruded aluminum alloy 6063-T5, min height 3 3/8” min base thickness 3/16”, min width 4”.
2. Slats to be interlocking, roll-formed with insulating backing.
3. Inside Curtain Slat Face: To match material and thickness of outside metal curtain slat.

B. Endlocks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Curtain Jamb Guides: Fabricate curtain jamb guides of angles, or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

A. Service Door: 22 ga. overhead coiling door formed with curtain of interlocking metal slats.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. STC Rating: Minimum 26.

D. Door Curtain Material: Painted galvanized steel.

E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

F. Bottom Bar: Manufacturer's standard based upon Basis-of-Design product.

G. Curtain Jamb Guides: Galvanized steel with finish matching curtain slats.

H. Hood: 24 ga. galvanized steel, manufacturer's standard hood.

1. Shape: Square.
2. Mounting: Face-of-wall.

I. Electric Door Operator:

1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
2. Operator Location: Front of hood.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Interior.
5. Motor Electrical Characteristics:

a. Horsepower: 1/2 hp.
b. Voltage: 230-V ac, single phase, 60 Hz.

6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic Wireless monitored safety edge.
8. Control Station(s): Manufacturer's standard 3-button control station, interior mounted.

J. Curtain Accessories: Equip door with weatherseals.

K. Door Finish:

1. Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted

hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Material: To match curtain material.
2. Shape: As indicated on drawings

B. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Single-jamb side, operable from inside only.

C. Chain Lock Keeper: Suitable for padlock.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.5 FINISHES, GENERAL

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 FINISHES

A. Galvanized Steel:

1. ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
2. Zirconium pre-treatment followed by baked-on polyester powder coat, with ~~custom~~ color as selected by Architect from manufacturer's full range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

2.7 ELECTRIC DOOR OPERATORS **Addendum No. 7 – September 23, 2022**

~~2. Usage Classification: Up to 20 cycles per hour.~~

~~3. Totally enclosed non ventilated gear head operator(s) rated (1/3) (1/2) or (3/4) hp as recommended by door manufacturer for size and type of door, 208 Volts, Single Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s). Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 8 to 9 inches per second. Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door.~~

~~4. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.~~

~~5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.~~

~~a. Electric sensing edge device: Automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and automatically reverse direction to the fully opened position. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.~~

~~b. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.~~

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.

2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location:

1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Motors: Reversible-type motor for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Sized to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust safeties. Replace damaged and malfunctioning equipment.

2. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventive maintenance, .
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 083300

SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Manually operated, non-fire-rated, face mounted counter doors.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports and stainless steel for adjacent components.

1.3 SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of locking devices, and other accessories.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar.
3. Guides.

D. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.4 WARRANTY

A. Beginning at Substantial Completion, provide a one (1) year Warranty with maintenance service on an as-needed basis. Maintenance shall be performed by skilled workers of the coiling-door Installer. Include repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance service, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 COUNTER DOOR ASSEMBLIES – GENERAL

A. Available Manufacturers: Basis of Design Product – Overhead Door Corp. 651 Stainless Steel, Face Mounted Rolling Counter Door. Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Clopay Building Products Company, Inc.
2. Wayne-Dalton Corp.
3. Cornell Door Company
4. Raynor.

B. Source Limitations: Obtain all components of coiling counter doors, grilles and coiling overhead doors, from a single source, and from a single manufacturer.

C. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

2.2 COUNTER DOORS

A. Door Curtain Material: Stainless steel.

B. Door Curtain Slats: Flat profile slats of 1-1/4-inch center-to-center height.

C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.

D. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

E. Manual Door Operation: Push-up operation.

F. Hood: Match curtain material and finish.

1. Shape: Square, unless otherwise indicated.
2. Mounting: As shown on Drawings.

G. Sill Configuration: Prefabricated stainless-steel sill and soiled dish table by others.

H. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn.

I. Curtain Accessories: Equip door with push/pull handles.

J. Door Finish:

1. Stainless-Steel Finish: No. 4 (polished directional satin). Finish shall apply to both slat faces.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Stainless-Steel Door Curtain Slats: ASTM A666, Type 304; sheet thickness of 0.025 inch; and as required. Provide at both interior and exterior curtain-slat faces.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods. Equip hood with intermediate support brackets as required to prevent sagging.

1. Stainless Steel: 0.025-inch-thick stainless-steel sheet, Type 304, complying with ASTM A 666.

2.5 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.6 CURTAIN ACCESSORIES

A. Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.7 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 083313

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Exterior storefront framing systems.
2. Interior entrance systems.
3. Manual-swing aluminum doors.

B. Related sections include the following:
1. Division 4 Section “Unit Masonry (Assemblies)” for mockup requirements to include aluminum framed storefront systems.
2. Division 7 Section “Joint Sealants” for joint sealants installed as part of aluminum entrance and storefront systems.
3. Division 8 Section “Glazed Aluminum Curtain Walls”.
4. Division 8 Section “General Glazing” for glazing in aluminum-framed storefront systems.
5. Division 8 Section “Door Hardware” for door hardware installed in aluminum door and frame assemblies.
6. Divisions 26 through 28 Electrical Sections for power wiring and low voltage requirements for electrified hardware.

1.3 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer’s standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide aluminum-framed entrance systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site in compliance with Division 1 Section “Project Meetings”.

1. The Pre-installation Conference shall include representatives of the Owner’s technology department and security vendors. Prior to proceeding with the Work, the Contractor shall coordinate all equipment and rough-in requirements with these Owner vendors to ensure all required pathways, junction boxes, etc., are installed correctly.

1.5 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency evidencing compliance with requirements.

D. Shop Drawings: For aluminum-framed entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work and the following:

1. Layout and installation details, including anchors.
2. Elevations at 1/4 inch = 1 foot, and window unit elevations at 3/4 inch = 1 foot scale.
3. Full-size section details of typical composite members, including reinforcement and stiffeners.
4. Details for flashing and drainage.
5. Location of weep holes.
6. Hardware, including operators.
7. Glazing details.
8. Accessories.
9. **Include point-to-point wiring diagrams showing the following:**

a. Power requirements for each electrically operated door hardware component.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

E. Cutaway Sample: For each type of vertical-to-horizontal framing intersection of systems made from minimum 6 inch lengths of full-size components, and showing details of the following:

1. Joinery.
2. Anchorage.

3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.
6. Structural sealant joints.

F. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

G. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

H. Qualification Data: For Installer.

I. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

J. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

K. Source quality-control reports.

L. Field quality-control reports.

M. Sample Warranties: For special warranties.

N. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the state in which the project is located, to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with the performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E330 as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity for relevant exposure category, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

2. Entrance Doors:

a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: According to AAMA 501.1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 0.36 Btu/sq. ft. x h x deg F (using Ucog=0.29), as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

J. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Sound Transmission Class: Not less than 32 for 1-inch insulated glazing and 36 for laminated glazing.
2. Outdoor-Indoor Transmission Class: Not less than 27 for 1-inch insulated glazing and 30 for laminated glazing.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

L. Performance Requirements of Operable Units: Testing shall demonstrate compliance with requirements indicated in AAMA 101-03 for air infiltration, water penetration, and structural performance for type, grade, and performance class of operable units required. Where required design pressure exceed the minimum for specified window grade, comply with requirements of AAMA 101, Section 3, “Optional Performance Classes,” for higher than minimum performance class.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each component and each type of entrance and storefront system through one source from a single manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field-testing, or in-service performance.

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding Standards: Comply with AWS D1.2, "Structural Welding Code - Aluminum.”

1.8 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Mockup shall be a component of the comprehensive mockup specified in Division 4 Section “Unit Masonry (Assemblies)”.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to the following:

1. Structural failures including excessive deflection.
2. Failure of system to meet specified performance requirements including water leakage, air infiltration or condensation.
3. Noise or vibration created by wind and thermal and structural movements.
4. Water penetration through fixed glazing and framing areas.
5. Adhesive sealant failures.
6. Cohesive sealant failures.
7. Failure of operating components to function normally.
8. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: 2 years from date of Substantial Completion.

D. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Basis of Design Products are by YKK AP America, Inc. Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Kawneer North America.
2. EFCO Corporation.
3. Oldcastle Building Envelope (formerly Vistawall Architectural Products).

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront systems as well as glazed aluminum curtain wall systems, including operable units and accessories, from the same manufacturer.

C. Storefront Framing Products:

1. Thermally Broken 2-inch x 4-1/2-inch Storefront Systems: YES 45 TU (center set, flush glazed storefront system for insulated glass).

a. For use generally at exterior storefront locations. Where removable mullions are a component of the hardware set for thermally broken (2-3/8-inch thick) entrance doors, 6-inch storefront systems are required.

2. Thermally Broken 2-inch x 6-inch Storefront Systems: YES 60 FI (center set, flush glazed storefront system for insulated glass).

a. For use generally at exterior storefront locations where the use of thermally broken (2-3/8-inch thick) doors AND removable mullions are a component of the assembly, and also where noted on Drawings or where required by wind loads against the overall frame.

3. Non-Thermally Broken 1-3/4-inch x 4-1/2-inch Storefront Systems: YES 45 FS (center set, flush glazed storefront system for monolithic glass).

a. For use at interior locations where noted on Drawings.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below:

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429.
4. Structural Profiles: ASTM B308
5. Bars, Rods, and Wire: ASTM B211.

6. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36.
2. Cold-Rolled Sheet and Strip: ASTM A1008.
3. Hot-Rolled Sheet and Strip: ASTM A1011.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

D. Glazing: Refer to Division 8 Section “General Glazing”.

E. Glazing Gaskets: Manufacturer’s standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

F. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer’s standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

G. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

H. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer’s option, provide compressible stripping for glazing and weatherstripping such a molded EPDM or neoprene gaskets complying with ASTM D2000 Designation 2C415 to 3BC620, or molded PVC gaskets complying with ASTM D2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.

I. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 COMPONENTS

A. Framing Components: Provide manufacturer's standard components complying with specified requirements.

B. Brackets and Reinforcements: Provide manufacturer’s standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, nonferrous shims for aligning system components.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

E. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing, compatible with adjacent materials and of type recommended by manufacturer.

G. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D2000 requirements or molded PVC complying with ASTM D2287 requirements.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.4 DOORS

A. Doors: Basis of Design Products; YKK AP America, Inc. – 50XT Wide Stile Door (thermally broken doors), and 50D Wide Stile Door (non-thermally broken). As scheduled, thermally broken doors shall be used at all exterior locations. Non-thermally broken doors shall be used at all interior locations.

1. Thermally Broken Door Construction: 2-3/8-inch overall thickness, with nominal 1/8-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded.
2. Non-Thermally Broken Door Construction: 1-3/4-inch overall thickness, with nominal 1/8-inch thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded.
3. Door Design: Wide stile (all doors).

    a. Stile Width: 5 inches.
    b. Top Rail: 6-1/2 inches.
    c. Mid Rail: 6-1/2 inches.
    d. Bottom Rail: 10 inches

1) Verify stile and rail dimensions indicated for entrance doors will properly accommodate and conceal prescribed hardware components, including, but not limited to, exit devices and closers. Report any discrepancies to the Architect.

4. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide non-removable glazing stops on outside of door.

B. Door Hardware: As specified in Division 8 Section “Door Hardware”.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Fabricate components for screw-spline frame construction.
2. Fabricate components for head and sill-receptor frame construction with shear-block construction at intermediate horizontal components.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual.”

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation. Provide ventilator units where detailed on Drawings.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Finish: AAMA 612-02 Combined Coatings, Class 1, Dark Bronze Anodic Finish. Coating thickness of no less than .018 mill.

1. Color must match glazed-aluminum curtain wall framing, along with various types of sheet metal flashing and trim, to the greatest extent possible.
2. Color uniformity shall not differ more than 5 Hunter units, in accordance with ASTM D2244.
3. Gloss retention shall not exceed 50% change following ASTM D523.
4. Chalk Resistance shall not exceed a Number 8 rating, based on ASTM D4214.

2.7 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

G. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

I. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.3 ADJUSTING AND CLEANING*

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Glazed aluminum curtain walls and accessories.

B. Related Sections include the following:
1. Division 7 Section "Joint Sealants" for joint sealants installed as part of glazed aluminum curtain wall system.
2. Division 8 Section “Aluminum-Framed Entrances and Storefronts” for aluminum doors installed in curtain wall systems, and for aluminum-framed entrances and storefronts.
3. Division 8 Section "General Glazing" for insulated glass assemblies to be installed in glazed aluminum curtain walls.

1.3 SYSTEM DESCRIPTION

A. General: Provide glazed aluminum curtain wall systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer’s standard units in assemblies similar to those indicated for this Project. Failures include the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide glazed aluminum curtain wall systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site in compliance with Division 1 Section “Project Meetings”.

1.5 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Refer to Performance Requirements Article in Part 2 of this Section for requirements.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency evidencing compliance with requirements.

E. Shop Drawings: For glazed aluminum curtain wall systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work and the following:

1. Layout and installation details, including anchors.
2. Elevations at 1/4 inch = 1 foot, and window unit elevations at 3/4 inch = 1 foot scale.
3. Full-size section details of typical composite members, including reinforcement and stiffeners.
4. Details for flashing and drainage.
5. Location of weep holes.
6. Glazing details.
7. Accessories.

F. Cutaway Sample: For each type of vertical-to-horizontal framing intersection of systems made from minimum 6 inch lengths of full-size components, and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.
6. Structural sealant joints.

G. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

H. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test

results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

I. Qualification Data: For Installer.

J. Source quality-control reports.

K. Field quality-control reports.

L. Sample Warranties: For special warranties.

M. Maintenance Data: For glazed aluminum curtain wall systems to include in maintenance manuals.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the state of the project, to design glazed aluminum curtain wall systems.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain wall systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain wall systems shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failures also include the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus ¼ inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, curtain wall assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, curtain wall assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity for relevant exposure category, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E 331, with no evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.36 Btu/sq. ft. x h x deg. F (using Ucog=0.29), as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.

3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows:

1. Sound Transmission Class: Not less than 32 for 1-inch insulated glazing and 36 for laminated glazing.
2. Outdoor-Indoor Transmission Class: Not less than 27 for 1-inch insulated glazing and 30 for laminated glazing.

L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg. F, ambient; 180 deg. F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg. F.
b. Low Exterior Ambient-Air Temperature: 0 deg. F.
c. Interior Ambient-Air Temperature: 75 deg F.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing glazed aluminum curtain wall systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for glazed aluminum curtain wall systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each component and each type of glazed aluminum curtain wall through one source from a single manufacturer. Manufacturer of curtain wall systems shall be the same as manufacturer of aluminum-framed storefront systems.

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field-testing, or in-service performance.

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance

requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.9 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace components that fail in materials or workmanship within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection.
b. Failure of system to meet specified performance requirements including water leakage, air infiltration or condensation.
c. Noise or vibration created by wind and thermal and structural movements.
d. Water penetration through fixed glazing and framing areas.
e. Adhesive sealant failures.
f. Cohesive sealant failures.
g. Failure of operating components to function normally.
h. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two (2) years from date of Substantial Completion.

C. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Basis-of-Design Products are by YKK AP America, Inc. Subject to compliance with requirements, other manufacturers offer products that may be incorporated into the Work include, but are not limited to, the following:

1. Kawneer North America.
2. EFCO Corporation.
3. Oldcastle Building Envelope (formerly Vistawall Architectural Products).

B. Curtain Wall Framing Products:

1. Thermally broken 2-1/2” x 7-1/2” curtain wall – YCW 750 OGP.

a. Contractor, through the delegated design process, shall engineer all curtainwall framing systems and include internal steel reinforcing as required to meet specified design loads.

2.2 COMPONENTS

A. Framing Members: Manufacturer's extruded or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Fabrication Method: Factory or field-fabricated shear block system.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing. Include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standard indicated below:

    a. Sheet and Plate: ASTM B209.
    b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
    c. Extruded Structural Pipe and Tubes: ASTM B429.
    d. Welding Rods and Bare Electrodes: AWS A5.10.
    e. Structural Profiles: ASTM B308.
    f. Bars, Rods, and Wire: ASTM B211

2. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

3. Steel Reinforcement:

    a. Structural Shapes, Plates, and Bars: ASTM A36.
    b. Cold-Rolled Sheet and Strip: ASTM A1008.
    c. Hot-Rolled Sheet and Strip: ASTM A1011.

2.3 GLAZING

A. Glazing and Glazing Sealants: Comply with Division 8 Section "General Glazing."

B. Glazing Gaskets: Manufacturer’s standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

C. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer’s standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

D. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

E. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer’s option, provide compressible stripping for glazing and weatherstripping such a molded EPDM or neoprene gaskets complying with ASTM D2000 Designation 2C415 to 3BC620, or molded PVC gaskets complying with ASTM D2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.

2.4 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials and of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.5 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components to resist water penetration with one of the following methods:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

F. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard shear-block system method.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Finish: AAMA 612-02 Combined Coatings, Class 1, Dark Bronze Anodic Finish. Coating thickness of no less than .018 mill (18 microns).

1. Color must match glazed-aluminum curtain wall framing, along with various types of sheet metal flashing and trim, to the greatest extent possible.
2. Color uniformity shall not differ more than 5 Hunter units, in accordance with ASTM D2244.
3. Gloss retention shall not exceed 50% change following ASTM D523.
4. Chalk Resistance shall not exceed a Number 8 rating, based on ASTM D4214.

2.7 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing curtain wall systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

1. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
2. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
3. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

E. Install glazing as specified in Division 8 Section "General Glazing." Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

F. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

G. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
2. Variation from Level: Limit variation from level to 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.
4. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensure glazed aluminum curtain wall system is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084413

SECTION 085654 – SECURITY WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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. Vision security windows.
2. Fixed, transaction security windows.

B. Related Requirements:

1. Section 042000 “Unit Masonry Assemblies”
2. Section 081113 "Hollow Metal Doors and Frames"
3. Section 099123 "Interior Painting" for field painting interior security windows.

1.3 COORDINATION

A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for window units.

B. Shop Drawings: For security windows.

1. Include plans, elevations, sections, and attachments to other work.

2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
3. Location of weep holes.
4. Hardware for sliding window units.
5. Glazing details.
6. Details of deal tray and speaking aperture.

C. Samples for Initial Selection: For frame members with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Framing: 12-inch- long sections of frame members.

E. Cutaway Sample: Corner of security window, made from 12-inch lengths of full-size components, and showing details of the following:

1. Joinery.
2. Anchorage.
3. Glazing.
4. Flashing and drainage.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Welding certificates.

C. Product Test Reports: For each type of security window and accessory indicated as ballistics resistant, for tests performed by a qualified testing agency.

D. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying with ASTM F 1233.

E. Sample Warranty: For special warranty.

F. Examination reports documenting inspections of substrates, areas, and conditions.

G. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

H. Field quality-control reports documenting inspections of installed products.

1. Field quality-control certification signed by Contractor

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3, "Structural Welding Code - Sheet Steel."
4. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with drawing designation.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.10 SEQUENCING

A. Field Painting: Except where security windows have been preglazed before installation, complete field painting of security windows before glazing installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including deflections exceeding 1/4 inch (6 mm).
b. Failure of welds.
c. Excessive air leakage.
d. Faulty operation of sliding window hardware.
e. Faulty operation of transaction drawers.
f. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:

1. Ballistics Resistance: Listed and labeled as Level 3 when tested according to UL 752.
2. Ballistics Resistance: HG3 when tested according to ASTM F 1233.
3. Ballistics Resistance: C when tested according to HPW-TP-0500.03.
4. Forced-Entry Resistance: Level V when tested according to HPW-TP-0500.03.
5. Forced-Entry Resistance: Class V when tested according to ASTM F 1233.

B. Structural Loads: Detention windows shall withstand the effects of wind loads, with no permanent deformation or breakage of components within window assembly when tested according to ASTM E 330.

1. Wind Loads: As indicated on Drawings.

C. Air Infiltration: Provide windows with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

D. Water Penetration under Static Pressure: Provide windows that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
1. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M).

2.2 FIXED, TRANSACTION SECURITY WINDOWS

A. Provide fixed, framed transaction windows with operable sash or ventilator capable of allowing transfer of currency and documents.

B. Configuration: One fixed-glazed panel

C. Framing: Fabricate perimeter framing, mullions, and glazing stops from steel as follows:

1. Profile: Manufacturer's standard with minimum face dimension indicated.

a. Minimum Face Dimension: 2 inches

2. Depth: Manufacturer's standard
3. Provide thermally improved construction for aluminum framing.

D. Head and Jamb Framing: Designed for gasket glazing.

E. Channel-Frame Sill: Formed from stainless steel and designed for sealant glazing.

1. Transaction Counter: Stainless steel, 18 inches deep by width of security window, with integral double ricochet deal tray.

F. Glazing and Glazing Materials: Comply with requirements in Section 088853 "Security Glazing."

G. Materials:

1. Mild Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
4. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
5. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.
6. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength.
7. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M).

2.3 FABRICATION

A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.

1. Provide units that are reglazable from the secure side without dismantling the nonsecure side of framing.
2. Prepare security windows for glazing unless preglazing at the factory is indicated.

B. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.

C. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.

1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

D. Glazing Stops: Finish glazing stops to match security window framing.

1. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.
2. Nonsecure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.

E. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or

discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

G. Factory-cut openings in glazing for speaking apertures.

H. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Comply with requirements in Section 088853 "Security Glazing."

I. Weather Stripping: Factory applied.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Steel Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

B. Steel Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.6 ACCESSORIES

A. Recessed, Nonricochet Deal Trays: Formed from stainless steel; fabricated with recessed bullet trap to ricochet bullets away from secure side, with exposed flanges for recessed installation into horizontal surface, and with sliding stainless-steel cover.

1. Clear Opening Size: 12 inches wide by 8 inches deep by 1-1/2 inches high
2. Bullet Trap Location: Both sides.
3. Ballistics Resistance: Same as security window
4. Listed and labeled as bullet resisting according to UL 752.

B. Speaking Apertures: Fabricate from [stainless steel] [security glazing], designed to allow passage of speech at normal speaking volume without distortion.

1. Shape: Circular
2. Ballistics Resistance: Same as security window
3. Listed and labeled as bullet resisting according to UL 752.

C. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.

D. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to [four] <Insert number> times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified testing agency; of type indicated below.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 27/A 27M cast steel or ASTM A 47/A 47M malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.

E. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

G. Compression-Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

H. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.

1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

I. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressures indicated.

J. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

K. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.

E. For glazing materials whose orientation is critical for performance, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same [forced-entry-resistance] [and] [ballistics-resistance] performance as security window.

B. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches (152 mm) from each corner and spaced not more than 12 inches (305 mm) o.c.

C. Glazed Framing: Provide gasket-glazed framing. Comply with installation requirements in Section 088853 "Security Glazing."

D. Removable Glazing Stops and Trim: Fasten components with security fasteners.

E. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.]Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.

F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.

C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.5 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Adjust transaction drawers to provide a tight fit at contact points for smooth operation and secure enclosure.

C. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.6 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

1. Lubricate sliding security window hardware.
2. Lubricate transaction drawer hardware.

B. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Section 088853 "Security Glazing" for cleaning and maintenance.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain security windows with transaction drawers.

END OF SECTION 085654

SECTION 087100 DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Related Sections:

1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
4. Division 8: Wood Doors.
5. Division 26 Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. ICC – International Building Code

D. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

E. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representatives for each manufacturer.
d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years’ experience in the distribution of commercial hardware.

a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
b. Hardware Schedule shall be prepared and signed by an AHC.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect. Furnish custom strikes, door wrap-arounds as needed. Existing frames and doors may need modification for new hardware as specified. Call out any discrepancies to the architect when submitting shop drawings for approval or before submission.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer’s Warranty:

1. Closers: Thirty years
2. Exit Devices: Five Years
3. Locksets: Limited Lifetime
4. All other Hardware: Two years.

1.8 OWNER’S INSTRUCTION:

A. Instruct Owner’s personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner’s requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner’s consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:	Approved:
Hinges	Stanley	Bommer, McKinney
Continuous Hinges	Stanley	Select, ABH
Locksets	Best (No substitute – Facility Standard)	
Cylinders	Best (No substitute – Facility Standard)	
Exit Devices	Precision	Von Duprin 98-32D, Sargent 19-GL-80 Series
Closers	Stanley D-4550	Dorma 8900, Norton 7500
Push/Pull Plates	Trimco	Burns, Rockwood
Push/Pull Bars	Trimco	Burns, Rockwood
Protection Plates	Trimco	Burns, Rockwood
Overhead Stops	Dorma	ABH, Glynn Johnson
Door Stops	Trimco	Burns, Rockwood
Flush Bolts	Trimco	ABH, Burns
Coordinator & Brackets	Trimco	ABH, Burns
Threshold & Gasketing	National Guard	Reese, K.N. Crowder

2.2 MATERIALS:

A. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush [concealed] bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
9. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3-hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 1 ½ -hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Fit ANSI A115.1 door preparation
5. Functions and design as indicated in the hardware groups
6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
9. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated
10. Provide sufficient curved strike lip to protect door trim
11. Lever handles must be of forged or cast brass, bronze or stainless-steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
12. Lock shall have self-aligning, thru-bolted trim
13. Levers to operate a roller bearing spindle hub mechanism
14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
15. Spindle to be designed to prevent forced entry from attacking of lever
16. Provide locksets with 7-pin removable and interchangeable core cylinders
17. Each lever to have independent spring mechanism controlling it
18. Core face must be the same finish as the lockset.

D. Mortise Deadbolt:
1. Tested and approved by ANSI A156.36, Operational Grade 1.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. 2-3/4-inch (70mm) backset
5. 1-inch throw deadbolt
6. Provide locksets with 7-pin core.

E. Exit Devices shall:

1. Tested and approved by BHMA for ANSI 156.3, Grade 1
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Furnish UL or recognized independent laboratory certified mechanical operational testing to 10 million cycles minimum.
4. Provide a deadlocking latchbolt
5. Non-fire rated exit devices shall have cylinder dogging.
6. Touchpad shall be “T” style
7. Exposed components shall be of architectural metals and finishes.
8. Lever design shall match lockset lever design
9. Provide strikes as required by application.
10. Fire exit devices to be listed for UL10C
11. UL listed for Accident Hazard
12. Shall consist of a cross bar or push pad, the actuating portion of which extends across, shall not be less than one half the width of the door leaf.

13. Provide vandal resistant or breakaway trim
14. Aluminum vertical rod assemblies are acceptable only when provide with the manufacturers optional top and bottom stainless steel rod guard protectors.

F. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

G. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16-inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½“ minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

H. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

I. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.

1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
2. Surface overhead stops shall be heavy duty bronze or stainless steel.

J. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

K. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

L. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

M. Armor Plates: Provide ANSI J101 with four beveled edges, 40 inches high by width less 1 inch on single or pairs of doors. Furnish oval-head countersunk screws to match finish.

1. Provide cutouts for hardware as listed in the hardware sets.
2. Provide Warnock Hersey labeled plates for 3-hour metal fire doors where allowed by local authority.

N. Door Bolts: Flush bolts for wood or metal doors.

1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

O. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.

1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
2. Provide mounting brackets for soffit applied hardware.
3. Provide hardware preparation (cutouts) for latches as necessary.

P. Quick Connect Power Transfer: Power transfer device shall be a steel housing and flexible tube. Secure and inconspicuous channel is to bring power from the frame to the door.

1. Precision EPT-12C
2. Tube shall contain 12 Wire bundle with Stanley Quick Connect Connectors one 4 wire connector consisting of two 18AWG wires and 2 24AWG wires and one 8 wire connector with 8 24AWG wires.

Q. Surface mounted Door Loop Power Transfer: Armored flex conduit is to bring power from the frame to the door. The tube shall accept up to 1/4” wire bundle and is 18” long.

1. Precision EPT-2
2. Wires as required by others.

R. Power Supply: Provide power supply PS873 series for Electric Latch Retraction exit devices. Provide the appropriate control circuit card necessary to operate the number of EL exit devices used at each opening. Example PS873X2
1. UL Listed for class II output
2. Include circuit breakers for protection of motherboard
3. 120 Volt AC input at 1 Amp
4. Control module shall include Fire alarm terminal contacts.

S. Power Transfer: Power transfer device shall be a steel housing and flexible tube. Secure and inconspicuous channel is to bring power from the frame to the door.
1. Von Duprin EPT Series
2. EPT-2, two 18 Ga. wires
3. EPT-10 ten 24 Ga. wires

T. Electromagnetic Locks: Certified by BHMA for A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: **500 lbf**
3. Inductive Kickback Peak Voltage: Not more than [**53**] [**0**] V.
4. Residual Magnetism: Not more than [**4 lbf]** [**0 lbf**] to separate door from magnet.

U. Power Supply: UL Listed, Field Selectable 12VDC or 24VDC output. The power supply will specifically be designed to support electric locks and access controls. The power supply uses 115 VACS at 800mA input. The power shall be able to be expanded to four station controls. The filtered and regulated output power is field selectable for 12 or 24 VDC.

1. Fire Alarm/Life Safety emergency release included in power supply.
2. Available options for multiple door options four or more control stations, Adjustable Time delay relay, Battery charging, Battery Backup.

V. Electric Door Strike: Certified by ANSI/BHMA 156.31, Grade 1. and listed for Burglary Protection ANSI/ UL1034 Grade 1.

1. For General use provide fail-secure electric strike and with fire-rated device.
2. Listed UL10C for Fire Door assemblies
3. Latchbolt monitor switch option when specified in hardware sets.
4. Provide the electric strike in the appropriate model that will accept a 5/8” or 3/4" latchbolt.

W. Door Position Switch: Provide door position switch for door status monitoring as indicated in hardware sets.

1. At all fired rated doors the door and frames, position switch preparation will be provided by the door and frame manufacturer or by an authorized label service agent.

X. Quick Connect plug-in connectors: Stanley quick connect plug-in must be used with a combination of the following components to work as a complete plug and play system.
1. Best locks series 45HW, 45HM, 8KW, 9KW, 9KM
2. To include Quick connectors to Best lock products Suffix “C” Example (45HW-7DEL14H DS **C)**
3. Precision Exit Devices 2000 Series, DE, DS, TS, TDS, LDS, ELR
4. To include Quick connectors to Precision Electric Exit Device products Prefix “C” Example (**C** ELR 2108 x V4908A TS**)**
5. Precision 12 Conductor Electric Power Transfer EPT-12C
6. Stanley 12 Hinges Conductor Hinge CECB179-12C

Y. Quick Connect Wire Harnesses: The Quick Connect wire harness shall have of one four wire connector and one eight wire connector. The four-wire connector has two 18AWG and two 24AWG wires. The eight-wire connector has eight 24AWG wires Stanley quick connect wire harnesses are available in various length’s, 3” (76mm), 6” (152mm), 12” (304mm), 26” (660mm) 32” (812mm) 38” (965mm), 44” (1117mm), 50” (1270mm) and 192” (4876mm).
1. Wire Harness that is terminated at both ends is specified as WH-size (Example WH-3).
2. Wire Harness that is terminated at one end with exposed pin head at the other is specified as WH-size P (Example WH-3P).
3. Wire Harness 6” (152mm) terminated at one end with bray leads on the other is specified as WH-6E.

Notes the Wire harnesses with suffix “E” has brae wire ends, is used to connect the quick connect harness to a hardwired connection.
Wire harnesses of different lengths may be combined to form a desired length
The maximum size hole needed to pass through the quick connect plug is 1” (25MM).

Z. Magnetic Door Holders: Provide magnetic door holders with Tri-Voltage that can be wired 12VDC, 24V AC/DC or 120V AC

1. Wall magnetic door holders shall be **Recessed**.
2. Armature shall be thru-bolted and can be provided with any projection required.
3. Models will be available in US28, sprayed finishes and US32D.
4 Floor mounted shall be provided for a single door or double door hold open application.

AA. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

BB. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.

1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.

CC. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.

1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.

DD. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½” for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

EE. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

FF. Keystone Web Key Management Software: Provide one, Keystone Web product “KSWN” key management software. Shall include

1. Configurable Password Policy for logins.
2. User friendly interface - Tile Icons and Customizable dashboard.
3. Easy Data Entry & Import to import/append data continuously.
4. Active Directory synchronization to reduce manual entry.
5. Configurable Email notifications for all keys and other items currently due back on a designated day, notifications when keys and items are issued, and notifications when keys and other items are returned.
6. Global Search functionality capable of listing all cores and their location, building and doors.
7. Cross-references people to cores and keys, doors, and buildings they access.
8. Customizable Reports.
9. Self-serve Password retrieval functionality.
10. Program shall be standalone or network capable, LAN or WAN compatible.

11. Flexibility: The software shall be capable of allowing an authorized user secure access to the software from anywhere, provided user can access their organization's secure network.
12. Encrypted database and SQL server express backend.
13. Software program is to be compatible with Windows 7 Professional 32/64 bit (Standalone PC). Windows 2008/2012 Server 32/64 bit.
14. Browser Requirements: Internet Explorer 10 or greater Microsoft Edge browser latest Firefox or Chrome Internet browsers.
15. Minimum Microsoft software Prerequisites: SQL Server 2014 Express or Greater. NET Framework 4.5 or greater.

GG. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys
2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 15 each Construction masterkeys
5. 1 each Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

2. Recommended locations for Architectural Hardware for flush wood doors (DHI).

3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

   a. Verify levers are free from binding.
   b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

Code	Name
AB	ABH Manufacturing Inc.
AIPH	AIPH
BE	Best Access Systems
BM	Bommer Industries
DM	Dorma Door Controls
NA	National Guard
PR	Precision
SD	Stanley Door Closers
SPEC	Special Lite
ST	Stanley
TR	Trimco

Option List

Code	Description
6	2-1/4" Door Thickness
C	QUICK CONNECT WIRING OPTION
C	Quick Connect Wiring System
N	Thru-Bolt w/ Flow-Thru
CD	CYLINDER DOGGING
FL	Fire Exit Hardware
FP	Fire Studs for 3 Hr. Fire Rating
LD	Less Dogging
3RO	Prefix option for 2000 Apex Series
AVB	Advanced Variable Backcheck
CSK	COUNTER SINKING OF KICK and MOP PLATES
LBR	LESS BOTTOM ROD

MLR	MOTORIZED LATCH RETRACTION
VIB	Double Visual Indictor Option
VIT	Visual Indictor Thumb-Turn
S300	STD. STRIKE - RIM AND TOP OF SVR DEVICES
S988	STANDARD. STRIKE - NARROW STILE RIM
CA-03	Cylinder Attachment Kit (Rim/SVR Device)
2-1/4"	2-1/4" Thick Doors
CSK-AP	COUNTER SINKING OF ARMOUR PLATES
P45-113	Extra Clearance Offset Brkt.
EPT Prep	EPT Prep (full mortise)
P45-180D	Drop Plate for Narrow Top Rail
P45HD-110	Spacer Block HD Arm on Rabbet
P45HD-112	Angle Brkt. - Shoe Support HD Arms
B4E-HEAVY-AP	BEVELED 4 EDGES - ARMOR PLATES
B4E-HEAVY-KP	BEVELED 4 EDGES - KICK PLATES
10-24 SSMS/LA	STAINLESS MACHINE SCREWS/LEAD ANCHOR
Cut to Length	Cut to Lenght (Specify)
Spec. Thickness	Special Door Thickness (Specify)
CORMAX PATENTED KEYING	Cormax Patented Keying

Finish List

Code	Description
AL	Aluminum
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
652	Satin Chromium Plated
689	Aluminum Painted
GREY	Grey
BLACK	Black
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull

Hardware Sets

SET #01

Doors: 001 Single Exit Alum Door

1	Continuous Hinge	661HD UL EPT Cut to length as req.	AL	ST
1	Exit Device	3RO C MLR 2103 CA-03 S988 x door thickness as req.	630	PR
1	Rim Cylinder	12E-72 PATD CORMAX PATENTED KEYING	626	BE
1	Anti-Vandal Pull	1097PHI-21S-CS4 x door thickness as req.	630	TR
1	Door Closer	CLD-4551 EDA AVB P45-180D P45HD-110 P45HD-112	689	SD

1	Overhead Stop	102X SL x size and door thickness as required	US32D	AB
1	Wire Harness	WH-XX x coordinate with door for LAR		ST
1	Power Transfer	EPT-12C		PR
1	Power Supply	RPSMLR2		PR
1	Wire Harness	WH-192P		ST
1	Door Position Switch	MC7		DM
1	Door Sweep	C699A x LAR		NA
1	Saddle Threshold	425 x LAR x 10-24 SSMS/LA	AL	NA

NOTE: Perimeter frame weatherstrip to be furnished by the frame manufacturer. Card reader, controller, head-end, software and infrastructure to be provided by the access control supplier. Presentation of a valid card retracts the exit device latch so the door can be pulled open. The door position switch monitors the door for door prop.

SET #02

Doors: 002C, 107B, 109B, 114A, 114B

1	Continuous Hinge	661HD UL Cut to length as required	AL	ST
1	Continuous Hinge	661HD UL EPT Cut to length as req.	AL	ST
1	Removable Mullion	KR-SL60	628	SPEC
1	Exit Device	3RO C MLR 2103 CA-03 S988 x door thickness as req.	630	PR
1	Exit Device	3RO 2101 LD S988 x door thickness as req.	630	PR
1	Rim Cylinder	12E-72 PATD CORMAX PATENTED KEYING	626	BE
1	Mortise Cylinder	1E-74 PATD CORMAX PATENTED KEYING	626	BE
1	Anti-Vandal Pull	1097PHI-21S-CS4 x door thickness as req.	630	TR
2	Door Closer	CLD-4551 EDA AVB P45-180D P45HD-110 P45HD-112	689	SD
2	Overhead Stop	102X SL x size and door thickness as required	US32D	AB
2	Door Position Switch	MC7		DM
1	Wire Harness	WH-192P		ST
1	Power Supply	RPSMLR2		PR
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-XX x coordinate with door for LAR		ST
2	Door Sweep	C699A x LAR		NA
1	Saddle Threshold	425 x LAR x 10-24 SSMS/LA	AL	NA

NOTE: Perimeter frame and door meeting stile weatherstrip to be furnished by the door and frame manufacturer. Card reader, controller, head-end, software and infrastructure to be provided by the access control supplier. Presentation of a valid card retracts the exit device latch so the door can be pulled open. The door position switch monitors the door for door prop.

SET #03

Doors 144, 150

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST

1	Electro-mech Lock	45HW-7DEU15J PATD C CORMAX PATENTED KEYING	626	BE
1	Door Closer	CLD-4551 EDA AVB	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Convex Wall Stop	1270CX	626	TR
1	Wire Harness	WH-XX x coordinate with door for LAR		ST
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192P		ST
1	Door Position Switch	MC7		DM
3	Door Silencers	1229A	GREY	TR

NOTE: Card reader, controller, head-end, software and infrastructure to be provided by the access control supplier. Presentation of a valid card unlocks the outside lever so that the latch can be retracted and the door opened. The door position switch monitors the door for door prop.

SET #04

Doors: 141A

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electro-mech Lock	45HW-7DEU15J PATD C CORMAX PATENTED KEYING	626	BE
1	Door Closer w/ Offset Shoe	CLD-4551 AVB x P45-113	689	SD
1	Overhead Stop	90X-S x size as required	626	DM
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Door Release Relay	RY-24L		AIPH
1	Wire Harness	WH-XX x coordinate with door for LAR		ST
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192P		ST
3	Door Silencers	1229A	GREY	TR

NOTE: Remote release by the AiPhone station by unlocking the outside lever so that the latch can be retracted and the door opened.

SET #05

Doors: 141B

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Deadlock	48H-7K PATD CORMAX PATENTED KEYING	626	BE
1	Electro-mech Lock	45HW-7DEU15J PATD C CORMAX PATENTED KEYING	626	BE
1	Door Closer	CLD-4551 x Regular Arm Mounted	689	SD
1	Overhead Stop	90X-S x size as required	626	DM
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Wire Harness	WH-XX x coordinate with door for LAR		ST
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192P		ST
3	Door Silencers	1229A	GREY	TR

NOTE: Remote release by the AiPhone station by unlocking the outside lever so that the latch can be retracted and the door opened allowing egress from Waiting B201 to the Corridor. The Deadlock is used to secure Door B201 when the office is closed.

SET #06

Doors: 002B, 004, 006, 107A, 109A, 111, 148, 151

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset with TT Indicator	45H-7TD15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Door Closer	CLD-4551 CS AVB	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
3	Door Silencers	1229A	GREY	TR

NOTE: Furnish 5075B Smoke gasketing at smoke doors.

SET #07

Doors: 118

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset	45H-7D15J PATD CORMAX PATENTED KEYING	626	BE
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Convex Wall Stop	1270CX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #08

Doors: 100

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset	45H-7D15J PATD CORMAX PATENTED KEYING	626	BE
1	Door Closer	CLD-4551 x Regular Arm Mounted	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Overhead Stop	90X-S x size as required	626	DM

SET #09

Doors: 108A

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset with TT Indicator	45H-7AT15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Overhead Stop	90X-S x size as required	626	DM

1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #10

Doors: 108B

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset with TT Indicator	45H-7AT15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Convex Wall Stop	1270CX	626	TR
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
3	Door Silencers	1229A	GREY	TR

SET #11

Doors: 143, 152

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset with TT Indicator	45H-7TD15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Convex Wall Stop	1270CX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #12

Doors: 143, 149

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset with TT Indicator	45H-7TD15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Overhead Stop	90X-S x size as required	626	DM
3	Door Silencers	1229A	GREY	TR

SET #13

Doors: 233, 234

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set	45H-0L15J VIB	630	BE
1	Convex Wall Stop	1270CX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #14

Doors: 126A

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST

1	Lockset	45H-7D15J PATD CORMAX PATENTED KEYING	626	BE
1	Door Closer	CLD-4551 EDA	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Convex Wall Stop	1270CX	626	TR
1	Smoke Seal	5075B x header x LAR		NA
2	Smoke Seal	5075B x jambs x LAR		NA

SET #15

Doors 122, 142, 132, 133

3	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Lockset	45H-7AB15J PATD CORMAX PATENTED KEYING VIB	626	BE
1	Door Closer	CLD-4551 EDA	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Convex Wall Stop	1270CX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #16

Doors: 130A, 130B

6	Hinges	CB168 4 1/2 X 4 1/2	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3911	630	TR
1	Lockset	45H-7D15J PATD CORMAX PATENTED KEYING	626	BE
1	Coordinator	3092	BLACK	TR
2	Door Closer	CLD-4551 x Regular Arm Mounted	689	SD
2	Overhead Stop	90X-S x size as required	626	DM
2	Kick Plate	K0050 10" x 1" LDW x B4E-Heavy x CSK	630	TR
1	Smoke Seal	5075B x header x LAR		NA
2	Smoke Seal	5075B x jambs x LAR		NA
1	Meeting Stile Smoke Seal	5070B x LAR		NA

SET #17

Doors: 131, 134

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset with TT Indicator	45H-7TD15J PATD CORMAX PATENTED KEYING VIT	626	BE
1	Door Closer	CLD-4551 EDA AVB	689	SD
1	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
1	Convex Wall Stop	1270CX	626	TR
3	Door Silencers	1229A	GREY	TR

SET #18

Doors: 005A, 135

6	Hinges	CB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Set Semi-Auto Flush Bolts	3825L X 3815L	630	TR
1	Dustproof Strike	3911	630	TR
1	Lockset	45H-7D15J PATD CORMAX PATENTED KEYING	626	BE
1	Coordinator	3092	BLACK	TR
2	Door Closer	CLD-4551 CS	689	SD
2	Kick Plate	K0050 10" x 1" LDW x B4E-Heavy x CSK	630	TR

SET #19

Doors: 117, 124, 127

2	Continuous Hinge	662HD UL LAR	AL	ST
1	Removable Mullion	KR822	689	PR
1	Exit Device	3RO 2103 CA-03 CD S300	630	PR
1	Exit Device	3RO 2101 CD S300	630	PR
2	Rim Cylinder	12E-72 PATD CORMAX PATENTED KEYING	626	BE
2	Mortise Cylinder	1E-74 PATD CORMAX PATENTED KEYING	626	BE
1	Door Pull	1191-4 x N x Door thickness as req.	630	TR
		NOTE: Install on active leaf only.		
2	Door Closer w/ Offset Shoe	CLD-4551 AVB x P45-113	689	SD
2	Overhead Stop	90X-S x size as required	626	DM
2	Kick Plate	K0050 10" x 2" LDW x B4E-Heavy x CSK	630	TR
2	Door Silencers	1229A	GREY	TR

END OF SECTION 087100

SECTION 088000 – GENERAL GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

a. Windows.
b. Doors.
c. Interior borrowed lites.
d. Aluminum framed entrances and storefronts.
e. Glazed aluminum curtain walls.

B. Related Sections include the following:

1. Division 8 Section “Fire-Rated Glazing” for fire-rated glazing in fire-rated hollow metal doors and frames and in fire-rated flush wood doors.
2. Division 8 Section "Hollow Metal Doors and Frames" for hollow metal doors and frames to receive general glazing.
3. Division 8 Section "Flush Wood Doors" for wood doors to receive general glazing.
4. Division 8 Section "Aluminum Entrances and Storefronts" for aluminum storefront framing systems to receive general glazing.
5. Division 8 Section "Glazed Aluminum Curtain Walls" for curtain wall systems to receive general glazing.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass or fabricated glass as defined in referenced glazing publications.

B. Glazing Fabricators: Firms that produce fabricated glass products from primary glass as defined in referenced glazing publications.

C. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

D. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

E. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the fabricating process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to fabricator's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the fabricating process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to fabricator's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

G. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the fabricating process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to fabricator's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: Defective manufacturing, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing purposes only. Confirm glass thicknesses by analyzing Project design loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E1300 and ICC's International Building Code (applicable version) according to the following requirements:

a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.

1) Wind Design Data: As indicated on (Structural) Drawings.
2) Basic Wind Speed: 90 mph
3) Importance Factor: 1.15
4) Exposure Category: C

b. Specified Design Snow Loads: As indicated on (Structural) Drawings, but not less than snow loads applicable to Project required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads".

c. Probability of Breakage for Vertical Glazing: 8 lites per 1,000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

d. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.

e. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1-inch, whichever is less.

f. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

g. Minimum Glass Thickness for Exterior Lites:

1) Manufacturer's standard to meet wind load criteria, but not less than 6 mm.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Performance Characteristics: Provide glass with performance properties specified based on manufacturer's published test data as determined according to procedures indicated below:

1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch-wide interspace.
3. Center-of-Glass thermal and optical performance properties shall be based on data and calculations from the current LBNL Windows 7.3 computer program expressed as Btu/sq. ft. x h x deg °F.
4. Fenestration Performance: Performance values that take into account the total fenestration (center-of-glass and framing members) normally identified with building energy codes such as ASHRAE-IESNA 90.1 and the IECC. Values can also be tested and certified by the National Fenestration Rating Council (NFRC).

1.5 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.6 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: Provide 12-inch-square samples of each glass product specified.

C. Glazing Schedule: Use same designations indicated on Drawings and specified herein for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. 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.

F. Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants have been tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: From a qualified testing agency, indicating the specified products comply with requirements based on comprehensive testing of standard products. Provide product test reports for each glass product.

I. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Monolithic Float Glass: Obtain all monolithic float glass from one source from a single manufacturer.

C. Source Limitations for Insulating Glass: Obtain all insulating-glass units from one source from a single fabricator using the same type of glass and other components for each type of unit specified.

D. Source Limitations for Laminated Glass: Obtain all laminated glass units from one source from a single fabricator using the same type of glass and other components for each type of unit indicated.

E. Source Limitations for Glazing Accessories: Obtain all glazing accessories from one source from a single manufacturer for each product and installation method indicated.

F. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to the following publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: NGA “Glazing Manual", “Sealant Manual” and “Laminated Glass Design Guide.”
2. SIGMA Publications: SIGMA TM-3000, “Vertical Glazing Guidelines.”
3. SIGMA Publication for Insulating Glass: SIGNA TM-3000, “North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.”

H. Preinstallation Conference: Conduct conference at Project site in accordance with Division 1 Section “Project Meetings”.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:

1. Insulated Glass Certification Council (IGCC)

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.10 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass fabricator agreeing to furnish replacements for insulating-glass units that deteriorate as defined in “Definitions” Article within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass fabricator agreeing to furnish replacements for laminated-glass units that deteriorate as defined in “Definitions” Article within specified warranty period indicated below

1. Warranty Period: 5 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass fabricator agreeing to furnish replacements for coated-glass that deteriorates as defined in “Definitions” Article within specified warranty period indicated below. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer’s written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as required by applicable glazing code.

2.2 MANUFACTURERS AND FABRICATION

A. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Monolithic Float Glass

a. Vitro Architectural Glass.
b. Guardian Glass, Inc.
c. Pilkington, Inc.
d. AGC.

B. Available Fabricators: Subject to compliance with requirements, fabricators of the products specified include, but are not limited to, the following:

1. Glass Enterprises, Inc.
2. Viracon, Inc.
3. Oldcastle Glass
4. Trulite.

2.3 MONOLITHIC FLOAT GLASS

A. Float Glass: ASTM C1036, Type 1, Class 1 (clear), Class 2 (tinted) transparent glass, flat, Quality q3 (glazing select); class, kind and condition indicated.

1. Provide Kind FT (fully tempered), Category 2, where safety glass is required by the applicable glazing codes.

B. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

1. Flatness Tolerances

a. Roller-Wave or Ripple: Deviation from flatness at any peak shall be targeted not to exceed 0.003-inch as measured per peak to valley for 1/4-inch (6 mm) thick glass.
b. Bow and Warp: The bow and warp tolerances targeted shall not exceed 1/32-inch per linear foot.

2.4 INSULATING GLASS

A. Insulating Glass Units – General: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E2190 for Class CBA units and with requirements specified in this Article.

1. **Type IG-1** Insulated Glass: Insulated glass units consisting of two lites of clear, annealed glass separated by a 1/2-inch sealed air space. Provide insulated units with low "E" coating. Unless otherwise noted, for use in the building's perimeter openings **primarily facing North and East**. Refer to Schedules and Frame Elevations for applied use.

a. Basis-of-Design Product: Subject to compliance with requirements, provide units fabricated with "Vitro Glass Solarban 60 Clear" or comparable product with the following characteristics:

1) Ultra Violet: 18%.
2) Visible Light Transmittance: 70%.
3) Total Solar Energy Transmittance: 34%.
4) Winter Night-time U Value: .29.

5) Summer Day-time U Value: .27.
6) Shading Coefficient: .45.
7) Solar Heat Gain Coefficient: .39.
8) Light to Solar Gain: 1.79.

b. Insulating Glass Unit Make-up

1) Outboard Lite: "Vitro Glass Solarban 60 Clear", 1/4 inch-thick.
2) Low "E" coating on 2nd. surface.
3) 1/2-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 1/4 inch-thick clear glass.
5) Overall Thickness: 1-inch.

2. **Type IG-2** Insulated Glass: Insulated glass units consisting of two lites of clear, annealed glass separated by a 1/2-inch sealed air space. Provide insulated units with low "E" coating. Unless otherwise noted, for use in the building's perimeter openings **primarily facing South and West**. Refer to Schedules and Frame Elevations for applied use.

a. Basis-of-Design Product: Subject to compliance with requirements, provide units fabricated with "Vitro Glass Solarban 70 Clear" or comparable product with the following characteristics:

1) Ultra Violet: 6%.
2) Visible Light Transmittance: 64%.
3) Total Solar Energy Transmittance: 24%.
4) Winter Night-time U Value: .28.
5) Summer Day-time U Value: .26.
6) Shading Coefficient: .31.
7) Solar Heat Gain Coefficient: .27.
8) Light to Solar Gain: 2.37.

b. Insulating Glass Unit Make-up

1) Outboard Lite: "Vitro Glass Solarban 70 Clear", 1/4 inch-thick.
2) Low "E" coating on 2nd surface.
3) 1/2-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 1/4-inch-thick clear glass.
5) Overall Thickness: 1-inch.

3. **Type IG-5** Insulated Silicone-Coated Spandrel Glass: Insulated glass units consisting of two lites of clear, annealed glass, separated by a 1/2-inch sealed air space. Provide insulated units with low "E" coating. Unless otherwise noted, for use in the building's perimeter openings **where noted on Drawings, primarily facing North and East**. Refer to Schedules for applied use.

a. Basis-of-Design Product: Subject to compliance with requirements, provide "Vitro Glass Solarban 60 Clear" or comparable product and "ICD High Performance Coatings, Opaci-Coat 300" with the following characteristics.

1) Ultra Violet: 0%.
2) Visible Light Transmittance: 4%.
3) Total Solar Energy Transmittance: 2%.
4) Winter Night-time U-Value: .29.
5) Summer Day-time U-Value: .27.
6) Shading Coefficient: .35.
7) Solar Heat Gain Coefficient: .30.
8) Light to Solar Gain: .13.

b. Insulating Glass Unit Make-up

1) Outboard Lite: "Vitro Glass Solarban 60 Clear", 1/4-inch-thick.
2) Low "E" coating on 2nd surface.
3) 1/2-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 1/4-inch-thick clear glass.
5) Spandrel Coating: On 4th surface (Color to be determined by Architect).
6) Overall Thickness: 1-inch

4. **Type IG-6** Insulated Silicone-Coated Spandrel Glass: Insulated glass units consisting of two lites of clear, annealed glass, separated by a 1/2-inch sealed air space. Provide insulated units with low "E" coating. Unless otherwise noted, for use in the building's perimeter openings **where noted on Drawings, primarily facing South and West**. Refer to Schedules for applied use.

a. Basis-of-Design Product: Subject to compliance with requirements, provide "Vitro Glass Solarban 70 Clear" or comparable product and "ICD High Performance Coatings, Opaci-Coat 300" with the following characteristics.

1) Ultra Violet: 0%.
2) Visible Light Transmittance: 4%.
3) Total Solar Energy Transmittance: 1%.
4) Winter Night-time U-Value: .28.
5) Summer Day-time U-Value: .26.
6) Shading Coefficient: .24.
7) Solar Heat Gain Coefficient: .21.
8) Light to Solar Gain: .19.

b. Insulating Glass Unit Make-up

1) Outboard Lite: "Vitro Glass Solarban 70 Clear", 1/4-inch-thick.
2) Low "E" coating on 2nd surface.
3) 1/2-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 1/4-inch-thick clear glass.
5) Spandrel Coating: On 4th surface (Color to be determined by Architect).

6) Overall Thickness: 1-inch

5. Provide Kind FT (fully tempered) where safety glass is required by the applicable glazing codes.
6. Locations: Insulating glass shall be used in all exterior windows, curtainwalls, storefronts/entrances, windows/vents and doors. At a minimum, insulating glass units in doors and sidelites (below the door head-height) and other locations indicated on Drawings or required by applicable code, shall consist of tempered glass.

B. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Dual air seal of polyisobutylene (PIB), and secondary seal of silicone.

2.5 LAMINATED GLASS

A. Laminated Glass – General: ASTM C1172 and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with interlayers to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated, and as needed to comply with requirements; one or multiple layers, formulated to absorb the majority of all naturally-occurring ultraviolet (UV) radiation from sunlight and provide long-term stability with built-in UV filtering.
3. Basis-of-Design Products: Subject to compliance with requirements, provide the following interlayer products, or comparable interlayer products by other manufacturers that meet the specified standard of quality:

   a. Polyvinyl butyral (PVB): Kuraray “Butacite.”
   b. Acoustic: Kuraray “Acoustic.”
   c. High-Security: Kuraray “SentryGlas.”

4. **Type ILG-1** Insulated Laminated Safety Glass: Insulated glass units consisting of one lite of 1/4-inch-thick clear tempered glass and one lite of 7/16-inch-thick laminated tempered glass (two 3/16 inch-thick lites of clear, tempered safety glass laminated with a high-security, .060 interlayer equal to Kuraray “SentryGlas”), separated by a 3/8 inch-thick sealed air space. Provide insulated units with low “E” coating. Primarily for use at the building’s primary entrance points **where noted on Drawings primarily facing North and East**. Refer to Schedules for applied use.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide units fabricated with “Vitro Glass Solarban 60 Clear” or comparable product, with the following characteristics:

      1) Ultra Violet: 18%.
      2) Visible Light Transmittance: 70%.
      3) Total Solar Energy Transmittance: 34%.
      4) Winter Night-time U Value: .29.

5) Summer Day-time U Value: .27.
6) Shading Coefficient: .45.
7) Solar Heat Gain Coefficient: .39.
8) Light to Solar Gain: 1.79.

b. Insulating Glass Unit Make-up:

1) Outboard Lite: "Vitro Glass Solarban 60 Clear," 1/4-inch-thick.
2) Low "E" coating on 2nd surface.
3) 3/8-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 7/16-inch-thick clear laminated glass as follows:

a) First Ply: Clear tempered glass, 3/16-inch-thick.
b) Interlayer: High-Security, 0.060-inch-thick; clear.
c) Second Ply: Clear tempered glass, 3/16-inch-thick.
d) Overall Inboard Lite Thickness: 7/16-inch.

5) Overall Thickness: 1-1/16-inch.

5. **Type ILG-2** Insulated Laminated Safety Glass: Insulated glass units consisting of one lite of 1/4-inch-thick clear tempered glass and one lite of 7/16-inch-thick laminated tempered glass (two 3/16-inch-thick lites of clear, tempered safety glass laminated with a high-security, .060 interlayer equal to Kuraray "SentryGlas"), separated by a 3/8-inch thick sealed air space. Provide insulated units with low "E" coating. Primarily for use at the building's primary entrance points **where noted on Drawings primarily facing South and West**. Refer to Schedules for applied use.

a. Basis-of-Design Product: Subject to compliance with requirements, provide units fabricated with "Vitro Glass Solarban 70 Clear" or comparable product, with the following characteristics:

1) Ultra Violet: 6%.
2) Visible Light Transmittance: 64%.
3) Total Solar Energy Transmittance: 24%.
4) Winter Night-time U Value: .28.
5) Summer Day-time U Value: .26.
6) Shading Coefficient: .31.
7) Solar Heat Gain Coefficient: .27.
8) Light to Solar Gain: 2.37.

b. Insulating Glass Unit Make-up:

1) Outboard Lite: "Vitro Glass Solarban 70 Clear," 1/4-inch-thick.
2) Low "E" coating on 2nd surface.
3) 3/8-inch-thick desiccant filled structural silicone spacer; Quanex Super Spacer TriSeal, GE3, black.
4) Inboard Lite: 7/16-inch-thick clear laminated glass, as follows:

a) First Ply: Clear tempered glass, 3/16-inch-thick.

b) Interlayer: High-Security, 0.060 inch-thick; clear.
c) Second Ply: Clear tempered glass, 3/16-inch-thick.
d) Overall Inboard Lite Thickness: 7/16-inch.

5) Overall Thickness: 1-1/16 inch.

6. **Type LG-1** Monolithic Two-Ply Laminated Safety Glass: Glass units consisting of two lites of 1/4-inch-thick clear tempered glass laminated with a .060 clear interlayer equal to Kuraray "SentryGlas". For use in the building's interior openings where noted on Drawings.

a. Overall Thickness: 9/16-inch

2.6 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C864.
2. EPDM, ASTM C864.
3. Silicone, ASTM C1115.
4. Thermoplastic polyolefin rubber, ASTM C1115.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rods as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C1281 and AAMA 800.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. VOC Content: For Sealants used inside weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, subpart D.

C. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

D. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

E. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

F. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where the length plus width is larger than 50-inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Tempered glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror and mirror mastic.

C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Gardner Glass Products

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; tinted.

1. Nominal Thickness: 6.0 mm
2. Tint Color: Bronze or Gray.

C. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Per manufacturer's written recommendations.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.

1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8

and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.

2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
3. Divider Trim: T-channels formed with front and back leg not less than 9/16 and 1 inch in height, respectively, and a thickness of not less than. 0.04 inch.

    a. Andscot Company, Inc.
    b. Stylemark, Inc.

4. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Fabricate mirrors in the shop to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. GANA Publications: "Laminated Glazing Reference Manual and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction

operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Division 5 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Division 9 Section “Gypsum Board” for interior and exterior gypsum board to be applied to metal framing systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

B. Shop Drawings: For substantial suspended bulkhead assemblies. Include layout, spacings, sizes, thicknesses, and types of light-gauge metal framing; fabrication; and fastening and anchorage details, including threaded rods and mechanical fasteners.

1. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For light-gauge metal framing assemblies required for substantial suspended bulkhead assemblies.

1. Architect reserves the right to revise quantities and locations of various suspension components if aesthetic requirements are not met per the proposed structural layout.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For embossed steel studs and runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Design framing systems in accordance with American Iron and Steel Institute Publication “North American Specification for the Design of Cold-Formed Steel Framing – Nonstructural Members”, except as otherwise shown or specified.

D. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. minimum, as required by applicable building code.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645; use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

    a. Minimum Base-Metal Thickness: 26 gauge, minimum.
    b. Depth: As indicated on Drawings.

2. Dimpled Steel Studs and Runners:

    a. Minimum Base-Metal Thickness: 28 gauge, minimum.
    b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering deflection tracks that may be incorporated into the Work include, but are not limited to, the following:

        1) Clark Dietrich Building Systems.
        2) Marino\WARE.
        3) FireTrak Corp.
        4) MBA Building Supplies.
        5) Metal-Lite.
        6) Steel Network, Inc. (The).
        7) Telling Industries.

D. Firestop Tracks: Provide one of the following options for isolating partition framing from structure above in specific fire-resistance-rated assemblies:

1. OPTION 1 - Standard Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide in conjunction with field-applied fire caulking and damming products to comply with prescribed fire-resistant assemblies as indicated.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering firestop tracks that may be incorporated into the Work include, but are not limited to, the following:

        1) Clark Dietrich Building Systems.
        2) Marino\WARE.
        3) FireTrak Corp.

4) Grace Construction Products; W.R. Grace & Co.
5) Metal-Lite.
6) Steel Network, Inc. (The).

2. OPTION 2 - Firestop Tracks with Intumescent Seals: Top runner, with slotted or solid legs, manufactured with factory-installed, minimum 2-mm-thick cured intumescent seal, affixed to steel profiles on one or both sides to provide full and continuous head-of-wall joint protection. Top runner shall be manufactured to allow partition heads to expand and contract with up to three inches of dynamic and static movement (1-1/2 overall movement) while maintaining continuity of fire-resistance-rated assembly indicated, of up to three-hour fire rating; UL-listed.

a. Available Products: Subject to compliance with requirements, manufacturers offering firestop tracks with intumescent seals that may be incorporated into the Work include, but are not limited to, the following:

1) Clark Dietrich Building Systems “BlazeFrame.”
2) Marino\WARE “FAS Track 1000.”

E. Curved Tracks: Manufacturer’s standard continuous lengths of segmented floor and head-of-wall tracks designed to form to radii indicated for non-load-bearing walls, ceilings and bulkheads, permanently secured into place by attaching segments to supports and to one another via pre-punched holes in flanges and webs. Tracks shall match gauge, depth and finish of adjoining framing members.

1. Provide manufacturer’s standard flexible, segmented angles and similar supplemental accessories necessary to form configurations as indicated.
2. Available Products: Subject to compliance with requirements, manufacturers offering non-load-bearing curved wall, ceiling and bulkhead tracks that may be incorporated into the Work include, but are not limited to, the following:

a. Clark Dietrich Building Systems “Contour Track.”
b. Radius Track Corporation “Ready Track.”
c. Duraframe Solutions “Curv-Trak.”
d. Flex-Ability Concepts “Flex-C Trac.”
e. SCAFCO Corp. “Perfect Curve.”

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 26 gauge, minimum.

G. Cold-Rolled Channel Bridging: Steel, 17 gauge minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 15-gauge-thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 26 gauge, minimum.
2. Depth: As indicated on Drawings.

I. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 26 gauge, and depth required to fit insulation thickness or depth indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 17 gauge and minimum 1/2-inch-wide flanges.

1. Depth: 2-1/2 inches minimum, or as indicated on Drawings.

D. Threaded Rods: For suspended gypsum board assemblies, where indicated; ASTM A 307, Grade A; roll-threaded to ASME, B1.1 UNC and UNF, and UNS Class 1A; low-carbon, zinc-plated coating, Fe/Zn 3AT per ASTM F 1941; threaded rod assemblies shall be field-painted, unless otherwise indicated.

1. Lengths, diameters and spacing as required for each suspended gypsum board assembly; provide minimum quantities of threaded rod assemblies as necessary, and in the most inconspicuous manner as possible.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 17 gauge uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 26 gauge, minimum.
b. Depth: 2-1/2 inches minimum, or as indicated on Drawings.

3. Dimpled Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 28 gauge, minimum.
b. Depth: 2-1/2 inches minimum, or as indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 26 gauge, minimum.

F. Grid Suspension System for Gypsum Board Ceilings (suggested framing system for custom, site-fabricated acoustical ceiling clouds/panels): ASTM C 645, direct-hung system composed of main

beams and cross-furring members that interlock. Include angle clips and other accessories to achieve required configuration, including curves.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering grid suspension systems for gypsum board ceilings that may be incorporated into the Work include, but are not limited to, the following:

    a. Drywall Grid System; Armstrong World Industries, Inc.
    b. Chicago Metallic Corporation.
    c. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
2. Multilayer Application: 16 inches o.c., unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c., unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation at orientation and spacing as indicated, and hold in place with Z-furring members.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c., unless otherwise indicated.
2. Carrying Channels (Main Runners): 48 inches o.c., unless otherwise indicated.
3. Furring Channels (Furring Members): 16 inches o.c., unless otherwise indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Specialty gypsum board.
3. Exterior glass-mat gypsum board.
4. Tile backing panels.
5. Trims and Accessories.
6. Joint treatment materials.
7. Sound attenuation blankets, acoustical sealants and other auxiliary materials.

B. Related Sections include the following:
1. Division 4 Section “Unit Masonry (Assemblies)” for gypsum sheathing, and for cavity air barrier installed over gypsum sheathing.
2. Division 5 Section “Cold-Formed Metal Framing” for structural framing and suspension systems that support gypsum board panels.
3. Division 7 Section “Thermal Insulation” for thermal insulation.
4. Division 9 Section "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

C. Samples for Initial Selection: For each type of trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

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. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.

B. Regular Gypsum Wallboard: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Applications - General: Offices, conference rooms and similar low impact locations.

4. Applications – Specific: Base and face layers to multi-layer, low impact, non-fire-rated assemblies, and all wall and bulkhead locations 8’-0” and higher above finished floor.

C. Gypsum Board, Type X: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Applications - General: Low impact, fire-rated wall, partition and ceiling applications where another specific type of gypsum wallboard is not required based on defined uses or the requirements of a specific UL Assembly.
4. Applications – Specific: Base layer of multi-layer, fire-rated wall and partition applications where another specific Type X gypsum board is required based upon defined use or the requirements of a specific UL Assembly.

D. Gypsum Ceiling Board: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Applications: Non-fire-rated ceilings locations.

E. Abuse-Resistant Gypsum Board: ASTM C1396 gypsum board, tested according to ASTM C1629.

1. Core: 5/8-inch, Type X.
2. Surface Abrasion: ASTM D4977, meets or exceeds Level 2 requirements.
3. Indentation: ASTM D5420, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM E695, meets or exceeds Level 2 requirements.
5. Hard-body Impact: ASTM 1629, meets or exceeds Level 1 requirements.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
8. Applications – General: Corridor walls up to 8’-0” (except where wall tile is the finish, use tile backing panels), classroom, small group instruction and other educational type rooms up to 8’-0”, stair towers, including the underside of stair runs, and similar locations subject to moderate abuse.
9. Applications – Specific: Face layer of multi-layer, fire-rated wall and partition assemblies where abuse-resistant gypsum board is required based upon defined use.

F. Moisture and Mold-Resistant Gypsum Board: ASTM C1396. With moisture and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
4. Applications - General: Wall and ceiling assemblies in toilet rooms, shower rooms, locker rooms and similar type rooms subject to moisture and humidity where the final wall finish is paint.
5. Applications – Specific: Face layer of multi-layer, fire-rated wall and partition assemblies where moisture and mold-resistant gypsum board is required based upon defined use.

G. Flexible Gypsum Board: ASTM C1396; manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.
3. Applications: Non-fire-rated curved walls and ceilings.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396. Manufactured to have increased fire-resistive capability.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Gypsum.
b. CertainTeed Corp.
c. Georgia-Pacific Gypsum LLC.
d. National Gypsum Company.
e. USG Corporation.

2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.
4. Applications: Fire-rated wall, partition and ceiling assemblies where required by a specific UL Assembly.

2.5 EXTERIOR GYPSUM BOARD

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Georgia-Pacific Gypsum LLC; DensGlass Sheathing.
b. CertainTeed Corporation; GlasRoc Sheathing.
c. National Gypsum Company; Gold Bond eXP Sheathing.
d. USG Corporation; Securock Glass-Mat Sheating.

2. Core: 5/8-inch, Type X.
3. Edges: Square.
4. Surface+
5. : Fiberglass mat on face, back and long edges.
6. Microbial Resistance: ASTM D6329, will not support microbial growth.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
8. Humidity Deflection: ASTM C1177, not more than 1/8-inch.
9. Permeance: ASTM E96, not less than 17 perms.
10. Applications: All exterior gypsum board substrate boards.

2.6 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CertainTeed Corporation; GlasRoc Tile Backer.
b. Georgia-Pacific Gypsum LLC; DensShield.
c. National Gypsum Company; Gold Bond eXP Tile Backer.
d. USG Corporation; Durock Glass-Matt Tile Backerboard.

2. Core: As indicated on Drawings.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
4. Applications: Substrate board for all interior ceramic and porcelain tile finishes.

2.7 TRIMS AND ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. United States Gypsum Co.
b. National Gypsum Co.
c. Georgia-Pacific Corp.
d. Fry Reglet Corporation.
e. Gordon Inc.
f. Pittcon Industries.

3. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (control) joint; one-piece, formed with V-shaped slot and removable strip covering slot opening.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

a. Cornerbead.

b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Reveals: Where specifically indicated and exposed to view; interior architectural, decorative gypsum board reveal channels and control joints; extruded accessories of profiles and dimensions indicated.

1. Material: Aluminum; alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
2. Finish: Provide corrosion-resistant primer compatible with joint compound and finish materials specified. Provide in manufacturer's standard Class I or II clear anodic finish; reveal trim shall be painted where indicated on Drawings.
3. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fry Reglet Corp.
b. Gordon Inc.
c. Pittcon Industries.

4. Shapes: Provide the following, where indicated; provide control joints where indicated or as required per standards:

a. Standard Reveals: Equal to Fry Reglet Corp. "Channel Screed Reveal;" 1/4-inch width, unless otherwise noted; for use on ceiling and horizontal or vertical (non-control joint) applications.
b. Wall-Ceiling Reveals: Equal to Fry Reglet Corp. "'F' Reveal;" 1/4-inch width, unless otherwise noted; for horizontal wall-to-ceiling or vertical wall-to-wall applications.
c. Control Joints: Equal to Fry Reglet Corp. "2-Piece Control Joint;" 1/4-inch width, unless otherwise noted; for use on ceiling and vertical control joint applications.
d. Provide other shapes if specifically indicated on Drawings.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.9 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Accumetric LLC; “BOSS 826 Acoustical Sound Sealant.”
    b. Franklin International; “Titebond Acoustical Smoke & Sound Sealant.”
    c. Grabber Construction Products; “Acoustical Smoke & Sound Sealant.”
    d. Hilti, Inc.; “CP 506.”
    e. Pecora Corporation; “AIS-919.”
    f. Specified Technologies, Inc.; “Smoke ‘N’ Sound Acoustical Sealant.”
    g. United States Gypsum Co.; “USG Sheetrock Brand Acoustical Sealant.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

    1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4 to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated by type above.
2. Type X: Where required for fire-resistance-rated assembly.
3. Ceiling Type: Ceiling surfaces.
4. Abuse-Resistant Type: As indicated by type above.
5. Mold-Resistant Type: As indicated by type above.
6. Flexible Type: Apply in double layer at curved assemblies.
7. Type C: Where required for specific fire-resistance-rated assembly indicated.
8. Glass-Mat Interior Type: As indicated on Drawings.
9. Acoustically Enhanced Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layer with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4 inch gap where panels abut other construction or penetrations.

B. Water-Resistant Backing Board: Install where indicated with 1/4 inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, and if not indicated, according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where required based upon installed condition.
4. U-Bead: Use where required based upon installed condition.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. Curved-Edge Cornerbead: Use at curved openings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Only where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view in the finished project, unless otherwise indicated.

5. Level 5: At panel surfaces that will receive vinyl wall coverings or other similar graphic material finishes.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 – TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Porcelain wall and floor tile.
2. Waterproof/crack isolation membrane.
3. Metal edge strips.
4. Engineered marble thresholds.

B. Related Requirements:

1. Division 3 Sections “Cast-in-Place Concrete” for Moisture Vapor Reduction Admixture.
2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 9 Section “Gypsum Board” for tile backing panels.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A 108 series of tile installation standards and in ANSI A137.1 and ANSI A137.3 apply to Work of this Section unless otherwise specified.

B. ANSI A 108 Series: ANSI A 108.01, 108.02, 108.1A, 108.1B, 108.1C, 108.4 through 108.6, and 108.8 through 108.17, ANSI 108.19 which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.

3. Meeting agenda includes but is not limited to:

   a. Tile and installation material compatibility.
   b. Grouting procedure.
   c. Maintenance and cleaning products and methods.
   d. Surface preparation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: Contractor shall provide manufacturer's color PDF images of tile, grout, accessories & transition strips for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, signed by product manufacturer.

D. Material Test Reports: For each tile-setting and grouting product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Waterproof Membrane
2. Joint sealants.
3. Metal edge strips.
4. Engineered marble thresholds.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of wall tile installation with metal edge strips. Coordinate location with Owner and Architect. Do not order tile and metal edge strips until site mock up is approved by the architect and the owner.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 and ANSI A137.3 for labeling tile packages.

B. Store tile and materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A 137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A 108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by current edition TCNA Handbook Ceramic, Glass and Stone Tile Installation and TCNA Handbook for Gauge Porcelain Tile and Gauge Porcelain Tile Panels/Slab methods specified in tile installation schedules, and other requirements specified.

C. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

D. Porcelain Tile - Type (PT1):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Olean

2. Composition: Porcelain.
3. Size: 12 inches by 12 inches
4. Pattern: Argent
5. Finish: Unpolished
6. Thickness: 9.5mm
7. Tile Color: On the Rocks
8. Grout Color: As selected from manufacturer’s full range of colors.
9. Installation Pattern: Monolithic

E. Porcelain Tile - Type (PT2):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Olean

2. Composition: Porcelain.
3. Size: 12 inches by 24 inches
4. Pattern: Argent
5. Finish: Honed
6. Thickness: 9.5mm
7. Tile Color: Clean Slate

8. Grout Color: As selected from manufacturer's full range of colors.
9. Installation Pattern: 1/3 Staggered Bond.

F. Porcelain Tile - Type (PT3):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. American Olean

2. Composition: Porcelain.
3. Size: 6 inches by 24 inches
4. Pattern: Argent
5. Finish: Honed
6. Thickness: 9.5mm
7. Tile Color: Memphis Blues
8. Grout Color: As selected from manufacturer's full range of colors.
9. Installation Pattern: 1/3 Staggered Bond.

G. Porcelain Tile - Type (PT4):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. American Olean

2. Composition: Porcelain.
3. Size: 6 inches by 12 inches Cove Base
4. Pattern: Argent
5. Finish: Unpolished
6. Thickness: 9.5mm
7. Tile Color: On the Rocks
8. Grout Color: As selected from manufacturer's full range of colors.
9. Installation Pattern: 1/3 Staggered Bond.

2.2 PRIMER

A. Multipurpose Bond-Promoting Primer: Low-VOC, synthetic resin-based primer with bond-promoting silica aggregates suspended in a dispersion, for interior and exterior applications.

1. Basis of Design:

   a. MAPEI Corporation: ECO Prim Grip.

2. Approved Manufacturers: Subject to compliance with requirement.

   a. Laticrete International, Inc.
   b. Custom Building Products

2.3 PATCHING AND SKIMCOATING COMPOUND

A. Cementitious patching and skimcoating compound.

1. Basis of Design:

a. MAPEI Corporation: Provide one of the following:

1) Mapecem Quickpatch.
2) Planiprep PSC.

2. Approved Manufacturers: Subject to compliance with requirement.

a. Laticrete International, Inc.
b. Custom Building Products

2.4 WATERPROOF/CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, which complies with ANSI A118.10 and ANSI A118.12 is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

1. Basis of Design:

a. MAPEI Corporation: Mapelastic AquaDefense.

2. Approved Manufacturers: Subject to compliance with requirements.

a. Laticrete International, Inc.: Hydroban.
b. Custom Building Products: RedGuard Waterproofing and Crack Prevention Membrane.

2.5 SETTING MATERIALS

A. Improved Modified Dry-Set Cement Mortar (Thin Set): ANSI A 118.4, HET, ANSI A118.11 and ANSI A118.15 HET.

1. Basis of Design:

a. MAPEI Corporation: Provide one of the following:

1) Ultraflex LFT
2) Keraflex Super
3) Granirapid System

2. Approved Manufacturers: Subject to compliance with requirement.

    a. Laticrete International, Inc.
    b. Custom Building Products

3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
5. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4 HT and ANSI A118.15.

B. Large and Heavy Tile Mortar, Modified Dry-Set Mortar ("H" as rated by ANSI): Comply with requirements in ANSI A118.4H. Provide product that is approved by manufacturer for application thickness up to 1/2 inch.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4HT.

4. Basis of Design:

    a. MAPEI Corporation: Provide one of the following:

        1) Ultralite S2
        2) Ultrabond ECO GPT
        3) Granirapid System

5. Approved Manufacturers: Subject to compliance with requirement.

    a. Laticrete International, Inc.
    b. Custom Building Products

2.6 GROUT MATERIALS

A. Polymer-Modified Tile Grout: Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients. Comply with requirements in ANSI A118.7.

1. Basis of Design:

    a. MAPEI Corporation: Ultracolor Plus FA

2. Approved Manufacturers: Subject to compliance with requirement.

    a. Laticrete International, Inc.

b. Custom Building Products

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

4. Basis of Design:

   a. MAPEI Corporation: Mapesil T Plus.

5. Approved Manufacturers: Subject to compliance with requirement.

   a. Laticrete International, Inc.
   b. Custom Building Products

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Floor/Wall Patch and Render Mortar: Quick-setting, polymer-modified, fiber-reinforced, cementitious rendering, patching, ramping and leveling mortar. Can be applied from 1/8 inch to 1-1/4 inches (3 mm to 3.2 cm).

1. Basis of Design:

   a. MAPEI Corporation: Planitop 330 Fast.

2. Approved Manufacturers: Subject to compliance with requirement.

   a. Laticrete International, Inc.
   b. Custom Building Products.

B. Cement Grout Haze Remover: Professional-strength, water-based formulation that helps remove cement grout haze from tile, concrete and acid-resistant natural-stone surfaces; acidic, low-odor, and nonflammable.

1. Basis of Design:

a. MAPEI Corporation: UltraCare Cement Grout Haze Remover

2. Approved Manufacturers: Subject to compliance with requirement.

a. Laticrete International, Inc.
b. Custom Building Products.

C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring and wall applications.

D. Water-Based Penetrating Grout Sealer: Provides protection against staining for use with sanded and unsanded cementitious grout joints. Can also be used as a pre-grouting sealer.

1. Basis of Design:

a. MAPEI Corporation: UltraCare Grout Sealer.

2. Approved Manufacturers: Subject to compliance with requirement.

a. Laticrete International, Inc.
b. Custom Building Products.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.10 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Engineered Marble Thresholds:

1. Manufacture: MSI or Equal
2. Color: As selected by Architect from manufacturer’s full range of colors.
3. Finish: Polished

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A 108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A 108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
    c. Verify when using tiles with all edges shorter than 15 inches (38 cm) in length, the maximum allowable variation in the substrate is 1/4-inch in 10 feet (6 mm in 3.05 m) from the required plane, with no more than 1/16-inch variation in 12 inches (1.5 mm in 30 cm) when measured from the high points in the surface.
    d. Verify when using large-format tiles with at least one edge of 15 inches (38 cm) and larger in length, the maximum allowable variation in the substrate is 1/8-inch in 10 feet (3 mm in 3.05 m) from the required plane, with no more than 1/16-inch of variation in 24 inches (1.5 mm in 61 cm) when measured from the high points in the surface.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A 108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A 108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of Tile Installation Standards for providing 95 percent mortar coverage:

    a. Tile composed of tiles 8 by 8 inches or larger.
    b. Tile floors consisting of rib-backed tiles.
    c. Tile floors in commercial applications

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Floor Tile (PT1): 1/8-inch.
2. Porcelain Wall Tile (PT2/PT3): 1/8-inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Comply with TCNA indications for type of installation and comply with their written recommendations for expansion joints for wall and floor applications. Provide expansion

joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Metal Edge Strips: Provide strips equal to Schluter System for transitions from tile to adjacent materials on floors, for wall transitions and corner applications. Refer to Drawings for details, and the following:

1. Outside Corner Trim: Schluter Systems, “Quadec-K”, Finish: Satin anodized aluminum.
2. Outside Edge Trim: Schluter Systems “Schiene”, Finish: Satin anodized aluminum.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

K. Engineered Marble Thresholds: Install engineered marble thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. Do not extend waterproofing or crack isolation membrane] under thresholds set in modified dry-setmortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A 118.10 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. Protection: Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

1. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
2. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation TCNA F122/F122A-23: Medium-set mortar on waterproof membrane in accordance with ANSIA 118.4. For Restroom applications, apply waterproof membrane in accordance with ANSI A 118.10.

a. Tile Type: PT1.
b. Mortar: Improved Modified Dry-Set Cement Mortar, Non-Sag, for Large and Heavy Tile LHT/Medium-bed, modified dry-set mortar.
c. Grout: High-Performance Cement Grout that meets or exceeds ANSI A118.7.

B. Interior Wall Installations:

1. Tile Installation W202I-23: Medium-set mortar over CMU units in accordance with ANSI A108.5. For Restroom applications, apply waterproof membrane in accordance with ANSI A118.10.

a. Tile Type: PT2/PT3.
b. Mortar: Improved Modified Dry-Set Cement Mortar, Non-Sag, for Large and Heavy Tile LHT/Medium-bed, modified dry-set mortar.
c. Grout: High-Performance Cement Grout that meets or exceeds ANSI A118.7.

2. Tile Installation W245-23: Medium-set mortar on backer units in accordance with ANSI A108.5 and A108.11. Restroom applications, apply waterproof membrane in accordance with ANSI A118.10.

a. Tile Type: PT.
b. Mortar: Improved Modified Dry-Set Cement Mortar, Non-Sag, for Large and Heavy Tile LHT/Medium-bed, modified dry-set mortar.
c. Grout: High-Performance Cement Grout that meets or exceeds ANSI A118.7.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Mineral-based, factory-painted acoustical ceiling panels.
2. Standard and specialty exposed grid suspension systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including, but not limited to, the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

F. Samples for Initial Selection: Contractor shall provide manufacturer's color PDF images of acoustical ceiling panels and suspension system for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in 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. Acoustical Panels: Full-size panels equal to 2 percent of quantity installed, in each pattern and color provided.
2. Suspension-System Components: Quantity of each exposed component equal 2 percent of quantity installed, in each color and style provided.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel or FRP ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS – TYPE (ACT1)

A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Armstrong World Industries, Inc.; Dune, No.1776.
2. USG Interiors, Inc.; Olympia Micro Panel, No. 4421.
3. CertainTeed, Saint-Gobain; Sand Micro, No. SHM-194.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish.
2. Color: White.
3. LR: 0.81.
4. NRC: Not less than 0.50.
5. CAC: Not less than 35.
6. Edge Detail: Angled Tegular.
7. Thickness: 5/8-inch.

8. Modular Size: Nominal 24 by 48 inches.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

D. Suspension System Type: Applications and types as indicated on Drawings and Paragraph 2.8.B and 2.10.A.

2.4 ACOUSTICAL PANELS – TYPE (ACT2)

A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Armstrong World Industries, Inc.; Dune, No.1774.
2. USG Interiors, Inc.; Olympia Micro Panel, No. 4221.
3. CertainTeed, Saint-Gobain; Sand Micro, No. SHM-154.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish.
2. Color: White.
3. LR: 0.81.
4. NRC: Not less than 0.50.
5. CAC: Not less than 35.
6. Edge Detail: Angled Tegular.
7. Thickness: 5/8-inch.
8. Modular Size: Nominal 24 by 24 inches.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

D. Suspension System Type: Applications and types as indicated on Drawings and Paragraph 2.7.B and 2.9.A.

2.5 ACOUSTICAL PANELS – TYPE (ACT3)

A. Manufacturers and Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Armstrong World Industries, Inc.; Ultima High NRC, No. 1940.
2. USG Interiors, Inc.; Mars High NRC, No. 86100.
3. CertainTeed, Saint-Gobain; Symphony M High NRC, No. 1222-85-1.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IV, mineral base with painted finish.
2. Color: White.
3. LR: 0.85.
4. NRC: Not less than 0.80.
5. CAC: Not less than 35.
6. Edge Detail: Square.
7. Thickness: 7/8 inch.
8. Modular Size: Nominal 24 by 24 inches.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

D. Suspension System Type: Applications and types as indicated on Drawings and Paragraph 2.7.B and 2.9.A.

2.6 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Wire Hangers, Braces, and Ties: Provide the following wire types, based on Project requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.

a. Hanger wire shall be 12 gauge/.105 (Diameter Range: .105-.107); Carbon: C1006; Length: 12 feet; Tensile: 54/62,000 KSI; Breaking Load Minimum: 475 pounds; Breaking Load Maximum: 540 pounds; Safe Load Maximum: 275 pounds; Finish: Hot Dip Galvanized; Galvanize Coating: Class I, in accordance with ASTM-641/A.

2. Stainless-Steel Wire: ASTM A 580, Type 304, nonmagnetic.

a. 1/16” air craft cable shall have a minimum breaking strength of 275 pounds.

3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

E. Hold-Down Clips: Provide for all air lock and security applications, including vestibules, restrooms and locker rooms, where occurs; provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.7 METAL SUSPENSION SYSTEM

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. Armstrong World Industries, Inc.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.
3. CertainTeed, Saint-Gobain.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically-zinc-coated, or hot-dip galvanized according to ASTM A 653, not less than G30 (Z90) coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Basis of Design: Equal to Armstrong, “Prelude”.
2. Structural Classification: Intermediate duty system.
3. End Condition of Cross Runners: Butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Material @ moisture exposed areas (i.e. restrooms, shower etc): Aluminum cold rolled sheet.
7. Cap Finish: White.

2.8 METAL EDGE MOLDINGS AND TRIM

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. Armstrong World Industries, Inc.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.
3. CertainTeed, Saint-Gobain.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635 and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.9 SPECIALTY SUSPENSION TRIM SYSTEM

A. Ceiling Clouds: Perimeter cloud trim for ceiling panels; refer to Drawings for extents and locations.

1. Manufacturers and Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; “Axiom Classic.”
b. USG Interiors, Inc.; Subsidiary of USG Corporation; “Compasso Elite.”
c. CertainTeed, Saint-Gobain; “Cloud Perimeter Trim”.

2. Trim Height: 6-inches high, as indicated on Drawings.
3. Color: White
4. Trim and Corners: Trim shall be equal to Armstrong World Industries, Inc. “Axiom Classic Trim,” with field-assembled corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: If indicated, install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs or any other part of steel deck. Attach hangers to structural members only.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Ceiling Clouds: For ceiling clouds and similar conditions, all suspension shall be aircraft cable. Hanger wire will not be accepted. Cables and other suspension components shall be installed as inconspicuously as possible, using minimum quantity of components and at the greatest distance from the perimeter as possible. Aircraft cable shall be straight and free from kinks and black in color. Paint all other suspension members to match color of painted systems and equipment above ceiling plane.

1. Architect shall reject Work not meeting the aesthetic and performance requirements, in which the Installer shall reinstall unsatisfactory components.

D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as indicated on Drawings.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; precisely match color of exposed panel surfaces using coating furnished or recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips for all air lock applications, including vestibules, and in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.
2. Rubber molding accessories.
3. Rubber Stair Treads.
4. Rubber Stair Landing Tile.

1.3 ACTION SUBMITTAL

A. Product Data: For each type of product.

A. Samples for Initial Selection: Samples are NOT required for the initial submittal. Architect/Interior Designer will request tile samples prior to final color selection as needed.

B. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient base and stair accessories shall comply with requirements of FloorScore certification.

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, the following manufacturers' products may be incorporated into the Work:

1. Basis of Design:

a. Tarkett – Johnsonite.

2. Approved Manufacturers:

a. Roppe Corporation, USA.

2.3 THERMOPLASTIC-RUBBER BASE (RB)

A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

1. Group: 1 (solid, homogeneous)

B. Style: B, Cove with top-set toe.

C. Thickness: 0.125 inch.

D. Height: Provide 4-inch-high at casework toe kick and 6-inch-high base in all other areas indicated.

E. Lengths: Coils in manufacturer's standard length but not less than 96 feet.

F. Outside Corners: Job-formed.

G. Inside Corners: Job-formed.

H. Surface: Smooth.

I. Colors: As selected by Architect from manufacturer's full range of colors and patterns produced for vinyl wall base complying with requirements indicated.

1. Provide a minimum of (90) color selections.

2.4 RUBBER MOLDING ACCESSORY

A. Description: Rubber nosing, cove caps, edging, reducers, joiners and transition strips.

B. Profile and Dimensions: As indicated on drawings.

C. Locations: Provide rubber molding accessories in areas indicated below:

1. Transition Strips, Reducers and Adaptors.

D. Colors and Patterns: As selected by Architect from manufacturer's full range of colors.

1. Provide a minimum of (36) color selections.

2.5 RUBBER STAIR ACCESSORIES (RBR)

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Rubber Treads: ASTM F 2169.

1. Type: TP (rubber, thermoplastic).
2. Class: 2, Pattern; Hammered (HTR) surface design, No. VIHMT.
3. Group: 2 (with contrasting grit tap for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
5. Nosing Height: 2 inches.
6. Thickness: 1/4 inch and tapered to back edge.

7. Size: Lengths and depths to fit each stair tread in one piece.

C. Landing Tile (RBR): Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

D. Locations: Provide rubber stair accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from manufacturer's full range of colors.

1. Provide a minimum of (107) color selections.

2.6 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement-based or blended hydraulic-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less
2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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. Luxury Vinyl Tile
2. Vinyl Composition Tile
3. Rubber Floor Tile

B. Related Requirements:

1. Division 3 Section “Cast-in-Place Concrete” for Moisture Vapor Reduction Admixture.
2. Division 9 Section “Resilient Base and Accessories” for resilient wall and accessories installed with resilient tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Attendees: The Installer and representatives as well as senior technician of manufacturers and fabricators involved in, or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.

B. Review methods and procedures related to resilient flooring including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review special designs and patterns.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

D. Samples: Contractor shall provide manufacturer's color PDF images of resilient flooring for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in 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. Floor Tile: Furnish one box for every 60 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum (1) classroom for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F Store floor tiles on flat surfaces.

1.10 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage7.1.

a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.

b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.

2. Static-generation values reported by manufacturers may be limited by sensitivity of testing equipment used; consult manufacturers if static generation is critical.
3. Static Generation: Less than 300V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
4. Static Decay: 5000 to zero V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.

2.2 LUXURY VINYL TILE (LVT)

A. Product: Subject to compliance with requirements, provide the following:

1. Manufacturer: AVA
2. Series: 2SPRK
3. Tile Standard: ASTM F 1700, Class III, Type B.
4. Thickness: 2.5mm
5. Wear Layer Thickness: 22 mil
6. Size: 18 inches by 18 inches.
7. Color: As selected by manufacturer's full line.
   a. Field Color: No. 2SP002 Hoist the Sail
   b. Accent A: No. 2SP009 Black-Eyed Susan
   c. Accent B: No. 2SP024 Land-Ho
   d. Accent C: No. 2SP045 Space Cadet
   e. Accent D: No. 2SP033 On the Half Shell
8. Installation: Monolithic.

2.3 VINYL COMPOSITION TILE (VCT)

A. Products: Subject to compliance with requirements, provide the following:

1. Manufacturer: Armstrong Commercial
2. Series: Standard Excelon
3. Tile Standard: ASTM F 1066, Class 2, through-pattern.
4. Thickness: 0.125
5. Wear Surface: Smooth
6. Size: 12 inches by 12 inches
7. Color: As selected by Architect from manufacturer's full range of colors.

   a. Field: Silk
   b. Accent A: Golden
   c. Accent B: Little Green Apple
   d. Accent C: Victorian Blue
   e. Accent D: Field Gray
   f. Accent E: Green – Color TBD.

8. Installation: Monolithic. Do not use basketweave pattern.

2.5 RUBBER FLOORING (RBR)

A. Product: Subject to compliance with requirements, provide the following:

1. Manufacturer: Tarkett – Johnsonite
2. Product Standard: ASTM F1344.

a. Group: 1-A (solid, homogeneous)

3. Thickness: 0.125 inch.
4. Size: 24 inches by 24 inches
5. Pattern: Hammered.
6. Color: As selected by Architect from manufacturer’s full range of colors.

a. Provide a minimum of (90) colors.

2.7 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile, conductivity and substrate conditions indicated unless noted otherwise. Product cannot void any portion of the manufacturer’s standard warranty.

1. Adhesives shall comply with the following limits for VOC content:

a. Adhesives: 50 g/L or less.

2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Provide adhesive for the following substrates:

a. Substrates without moisture vapor reduction admixture: Porous Adhesive.
b. Substrates with moisture vapor reduction admixture: Non-Porous Adhesive.

4. Luxury Vinyl Tile Adhesives: Per manufacturer’s recommendations.
5. Vinyl Composition Tile Adhesives: Per manufacturer’s recommendations.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by the floor tile manufacturer for VCT .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Receive Resilient Tile Floor Manufacturer's written approval of substrate required before installation of any tile flooring. The Carpet and Resilient Tile Contractor is responsible for obtaining the Resilient Tile Flooring Manufacturer's written approval of the floor as an acceptable substrate for the installation of manufacturer's tile product specified. If the floor is not acceptable to the manufacturer, the general contractor is responsible for preparing the floor to receive the new tile, as specified in order paragraphs of this specification, including an underlayment or leveling compound where necessary to meet all requirements for a manufacturer's approval of the substrate.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.
2. Lay tiles in pattern of colors and sizes indicated on Drawings.
3. For all radius cuts, utilize laser or water jet cutting system. Tile shall not be cut in the field.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient floor tile surfaces before applying liquid cleaners, sealers, and finish products.

1. Sealer: Apply (2) coats of liquid floor polish to all VCT surfaces.
2. Finish: Apply (4) coats of liquid floor polish to all VCT surfaces.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 – TILE CARPETING – ALTERNATE BID

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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. Modular carpet tile.

B. Related Requirements:

1. Division 3 Section “Cast-in-Place Concrete” for moisture vapor reduction admixture.
2. Division 9 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Attendees: The Installer and representatives as well as senior technician of manufacturers and fabricators involved in, or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.
2. Review methods and procedures related to resilient flooring including, but not limited to, the following:
   a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   c. Review special designs and patterns.
   d. Review delivery, storage, and handling procedures.
   e. Review ambient conditions and ventilation procedures.
   f. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: Contractor shall provide manufacturer’s color PDF images of carpet tile for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 3 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floor covering Installers Association at the Master II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT)

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

1. Manufacturer: Shaw Contract
2. Collection: On the Edge
3. Pattern: 59114 Vertical Edge Tile
4. Color: 67555 Gunmetal Verge
5. Size: 18 inches by 36 inches
6. Backing: EcoWorx Tile
7. Installation: Monothlic

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation on porous and non-porous surfaces.

1. Substrates without moisture vapor reduction admixture: Porous Adhesive.
2. Substrates with moisture vapor reduction admixture: Non-Porous Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division Section 3 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. For wood subfloors, where occur, verify the following:

1. Underlayment over subfloor complies with requirements specified in Division Section 6 "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

1. Carpet installation shall begin at the center point of the room and work out to the perimeter walls. Installation pattern to be ashlar.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097723 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Shop-fabricated, fabric-wrapped wall panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For fabric-wrapped wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

C. Samples for Initial Selection: Contractor shall provide manufacturer's color PDF images of fabric facing material for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, conduit and thermostats.

B. Product Certificates: For each type of fabric-wrapped wall panel, from manufacturer.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

C. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive fabric-wrapped wall panels.

C. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fabric sagging, distorting, or releasing from panel edge.
b. Warping of core.

2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRIC-WRAPPED WALL PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Basis of Design:

a. Sound Seal.

2. Approved Manufacturers:

a. Acoustical Solutions
b. Acoustical Surfaces
c. Essi Corp.
d. Kinetics Noise Control, Inc.
e. MBI Products Company, Inc.
f. Sound Concepts.
g. Wall Technology, Inc.; an Owens Corning Company.

B. General Requirements for Fabric-Wrapped Wall Panels: Panels shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Fabric-Wrapped Wall Panels: Manufacturer’s standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame. 2-inch-thick rigid fiberglass board with a density of 6pcf. Panel edges shall be hardened with resin.

1. Basis of Design:

    a. Sound Seal S-2000.

2. Facing Material: Manufacturer's standard woven polyester fabric from same dye lot;
3. Nominal Core Density: 6 to 7 lbs./cu. ft.
4. Nominal Overall Panel Thickness: 2 inches.
5. Noise Reduction Coefficient: Not less than NRC 1.15 for Type A mounting, per ASTM C423.
6. Panel Width: As indicated on the Drawings.
7. Panel Height: As indicated on the Drawings.
8. Edge Detail: Square.
9. Corner Detail: Square.
10. Fabric: Guilford of Maine, FR701, Style 2100.
11. Color: As selected by Architect from manufacturer's full range of colors.
12. Mounting: Back-mounted with manufacturer's standard adhesive and impaling clips secured to substrate.

2.2 FABRICATION

A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

C. Facing Material and Lining Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

    1. Square Corners: Tailor corners. Heat seal vinyl fabric seams at corners.
    2. Radius and Other Non-Square Corners: Attach material so there are no seams or gathering of material.
    3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:

    1. Thickness.
    2. Edge straightness.
    3. Overall length and width.
    4. Squareness from corner to corner.
    5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fabric-wrapped wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with fabric-wrapped, wall panel manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus

B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 099123 – PAINTING

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 surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will supply a color selection.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Acoustical wall panels.
c. Metal toilet enclosures.
d. Metal lockers.
e. Unit kitchens.
f. Elevator entrance doors and frames.
g. Elevator equipment.
h. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

    a. Anodized aluminum.
    b. Stainless steel.
    c. Chromium plate.
    d. Copper and copper alloys.
    e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Requirements:

1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 2 Section "Cement Concrete Pavement" for traffic-marking paint.
3. Division 5 Section "Structural Steel" for shop priming structural steel.
4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
5. Division 6 Section "Architectural Woodwork" for shop priming interior architectural woodwork.
6. Division 8 Section " Hollow Metal Doors and Frames" for factory priming steel doors and frames.
7. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by

manufacturer's catalog number and general classification. Submit in same format as specification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

B. Colors: Match Architect's color selections.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Submit 4 sets of samples of each final color and finish.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to be 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.

E. Certifications:

1. Furnish a letter from the paint manufacturer or their factory representative certifying that the paint system proposed for this project are equal to or better than the specified systems in appearance and performance levels. Submit proof of equivalency for approval including generic type, descriptive information, VOC content, performance data, solids by volume, and recommended film thickness. Submittals not accompanied by this certification will be returned, "REJECTED."

F. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

    a. Provide mock up of first and second coats of block filler or primer for approval of application.
    b. Wall Surfaces: Provide samples on at least 100 sq. ft.
    c. Small Areas and Items: Architect will designate items or areas required.

D. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface. Where materials are being applied over previously painted surfaces, apply mock up samples and perform field testing to check for compatibility, adhesion, and film integrity of the new materials to existing painted surfaces. Report in writing any condition that may affect application, appearance, or performance of the specified coating system.

1. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
2. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

C. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver left-over paint materials to Owner.

1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:

a. Exterior: 2 gallons of each color applied.
b. Interior: 1 case of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, provide products from one of the following manufacturers. Sherwin-Williams is the basis of design and establishes the standard of quality required.

B. Manufacturers' Names:

1. Sherwin Williams (SW).
2. Glidden.
3. PPG.
4. Benjamin Moore.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience. Each system should be from the same manufacturer.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match Architect's samples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

C. Where materials are being applied over previously painted surfaces, apply mock up samples and perform field testing to check for compatibility, adhesion, and film integrity of the new materials to existing painted surfaces. Report in writing any condition that may affect application, appearance, or performance of the specified coating system.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. All surfaces must be clean, dry, and free of all oil, grease, surface contaminants, and substances that could impair adhesion.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

2. All previously coated surfaces shall clean, dry, dull, and in sound condition prior to coating. All loose paints (either visible or not) shall be removed to expose a sound surface for repainting. All smooth, glossy surfaces shall be abraded to impart a surface profile that will promote adhesion of the subsequent coating system. A test-patch shall be applied prior to a full installation to assure adequate adhesion will be achieved.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
3. For Concrete Floors:
    a. Surface must be clean, dry, and in sound condition. Remove stains, oil, dust, grease, dirt, rust, release agents, curing compounds and hardeners, salts, efflorescence, laitance, and other contaminants and foreign material to ensure adequate adhesion.
    b. Follow recommendations as listed in the Sherwin Williams / General Polymers G-1 Surface Preparation Guide and ICRI Guideline #310-2-1997 for surface preparation.
    c. Provide Concrete Surface Profile (CSP) as recommended by manufacturer for specified systems.
    d. Determine alkalinity and moisture content of surfaces by performing appropriate tests. Document results in writing to GC and architect.
4. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
        1) Existing Wood: Scuff-sand/mechanically abrade the existing finish to impart a surface profile followed by thorough cleaning with a commercial cleaner/degreaser to remove all surface contaminants and rinse thoroughly.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    c. If transparent finish is required, back-prime with spar varnish.

d. Back-prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

5. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Power Tool Clean steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 3.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
6. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
7. Interior Grilles, Louvers and Sprinkler Escutcheons shall be painted in the field to match adjacent material color. Contractor shall prep and prime factory finished items to receive new paint finish in the field.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in

place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Exposed uninsulated metal piping.
2. Exposed uninsulated plastic piping.
3. Exposed pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panel boards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. All interior and exterior exposed gypsum wallboard, including any bulkheads and soffits to be painted.

I. All interior and exterior ferrous metal to be painted including any lintels, railings, grilles, and louvers (does not include factory or pre-finished items).

J. All hollow metal doors and frames, interior and exterior, shall be painted.

K. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

L. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

M. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

N. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

O. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and

3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.

    a. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:

    a. Quantitative material analysis.
    b. Abrasion resistance.
    c. Apparent reflectivity.
    d. Flexibility.
    e. Washability.
    f. Absorption.
    g. Accelerated weathering.
    h. Dry opacity.
    i. Accelerated yellowness.
    j. Recoating.
    k. Skinning.
    l. Color retention.
    m. Alkali and mildew resistance.

3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

B. Pre-installation Meetings:

1. Schedule a conference and inspection to be held on-site before field application of coating systems begins.
2. Conference shall be attended by Contractor, Owner's representative, Engineer, Construction Manager, coating applicators, and a representative of coating material manufacturer.
3. Topics to be discussed at meeting shall include:

    a. A review of Contract Documents and accepted shop drawings shall be made and deviations or differences shall be resolved.
    b. Review items such as environmental conditions, surface conditions, surface preparation, application procedures, and protection following application.

c. Establish which areas on-site will be available for use as storage areas and working area

4. Pre-construction conference and inspection shall serve to clarify Contract Documents, application requirements and what work should be completed before coating application can begin.
5. Prepare and submit, to parties in attendance, a written report of pre-installation conference report shall be submitted with 3 days following conference.
6. Field Samples:

   a. Provide a full coating system to the required sheen, color, texture, and recommended coverage rates. Simulate finished lighting conditions for reviewing in-place work.

7. The Architect, Construction Manager or Owners Representative will select one room, area, or combination of areas and surfaces and conditions for each type of coating and substrate to be coated. Apply coatings in this room, area, combination of areas and surfaces according to the schedule, or as specified. After finishes are accepted, this room, area or combination of areas and surfaces will serve as the standard of quality and for evaluation of coating systems of similar nature.
8. A manufacturer's representative shall be available upon request by the General Contractor or Painting subcontractor, to advise applicator on proper application technique and procedures.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semi-Gloss Acrylic-Enamel Finish: two finish coats over a rust-inhibitive primer.

a. Primer: SW, Pro-Industrial Pro-Cryl Universal Metal Primer, B66-310 series
b. Finish Coats: SW, Waterbased Acrolyn 100 Waterbased Urethane Gloss.

B. Previously Painted Ferrous Metal: Provide the following finish systems over exterior previously painted ferrous metal. Primer is not required on shop-primed items. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over an adhesion promoting primer.

a. Spot Primer (for bare or rusted areas): SW, Pro-Industrial Pro-Cryl Universal Metal Primer, B66-310 series.
b. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
c. Finish Coats: SW, Waterbased Acrolyn 100 Waterbased Urethane Gloss.

C. Galvanized Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

a. Primer: SW, Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 series.
b. Finish Coats: SW, Waterbased Acrolyn 100 Waterbased Urethane Gloss.

D. Previously Painted Galvanized Metal: Provide the following finish systems over exterior previously painted galvanized metal. Primer is not required on shop-primed items. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over an adhesion promoting primer.

a. Spot Primer (for bare or rusted areas): SW, Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 series
b. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
c. Finish Coats: SW Waterbased Acrolyn 100 Waterbased Urethane Gloss.

3.8 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish (Ceiling and Bulkhead Applications): Two finish coats over a primer.

a. Primer: SW, ProMar 200 Zero VOC Latex Primer, B28W600.
b. Finish Coast: SW, ProMar 200 Zero VOC Latex Flat, B30W2650 series.
**Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

2. Low Luster Acrylic-Enamel Finish (Wall Application @ Administration): Two finish coats over a primer.

a. Primer: SW, ProMar 200 Zero VOC Latex Primer, B28W600.
b. Finish Coats: SW, ProMar 200 Zero VOC Latex Eg-Shel, B20W2650 series.
**Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

3. Semi-Gloss Acrylic-Enamel Finish (Wall Application): Two finish coats over a

primer.

a. Primer: SW, ProMar 200 Zero VOC Latex Primer, B28W600.
b. Finish Coats: SW, ProMar 200 Zero VOC Latex Semi-Gloss, B31W2650 series. **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

B. Previously Painted Gypsum Board: Provide the following finish systems over previously painted interior gypsum board surfaces. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Flat Acrylic Finish (Ceiling & Bulkhead Application): Two finish coats over an adhesion promoting primer.

a. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
b. Finish Coats: SW, ProMar 200 Zero VOC Latex Flat, B30W2650 series. **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

2. Low Luster Acrylic-Enamel Finish (Wall Application @ Administration): Two finish coats over an adhesion promoting primer.

a. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
b. Finish Coats: SW, ProMar 200 Zero VOC Latex Eg-Shel, B20W2650 series. **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

3. Semi-Gloss Acrylic-Enamel Finish (Wall Application): Two finish coats over an adhesion promoting primer.

a. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
b. Finish Coats: SW, ProMar 200 Zero VOC Latex Semi-Gloss, B31W2650 series. **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semi-Gloss Finish: Two finish coats over a primer.

a. Primer: SW, Pro-Industrial Pro-Cryl Universal Metal Primer, B66-310 series
b. Finish Coats: SW, Pro-Industrial Waterbased Catalyzed Epoxy Gloss.

D. Previously Painted Ferrous Metal: Provide the following finish systems over previously painted ferrous metal. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Semi-Gloss Finish: Two finish coats over an adhesion promoting primer.

a. Spot Primer (for bare or rusty areas): SW, Pro-Industrial Pro-Cryl Universal Metal Primer, B66-310 series
b. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
c. Finish Coats: SW, Pro-Industrial Waterbased Catalyzed Epoxy Gloss.

E. Galvanized Metal: Provide the following finish systems over galvanized metal:

1. Semi-Gloss Finish: two finish coats over a primer.

a. Primer: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 series
b. Finish Coats: Pro Industrial Waterbased Catalyzed Epoxy Gloss.

F. Previously Painted Galvanized Metal: Provide the following finish systems over previously painted galvanized metal. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Semi-Gloss Finish: two finish coats over an adhesion promoting primer.

    a. Spot Primer (for bare or rusty areas): Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 series
    b. Finish Coats: SW, Pro-Industrial Waterbased Catalyzed Epoxy Gloss.

G. Dry Fog Paint: Provide where indicated for painted exposed structure.

1. Provide dry fog paint system according to approved manufacture's recommendations.

    a. Primer: SW, Pro-Industrial Pro-Cryl Universal Metal Primer, B66-310 series
    *Omit primer on clean galvanized surfaces
    b. Finish Coats, SW, Pro-Industrial Waterborne Acrylic Dryfall Flat, B42W81 series

H. Concrete Masonry Units: Provide the following finish systems over primer for wall applications.

1. Semi-Gloss Finish: Two finish coats over a primer.

    a. Filler: SW, PrepRite Block Filler, B25W25.
    b. Finish Coats: SW, ProMar 200 Zero VOC Latex Semi-Gloss, B31W2650 series
    **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

I. Previously Painted Concrete Masonry Units: Provide the following finish systems over an adhesion promoting primer for wall applications. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Semi-Gloss Finish: Two finish coats over a primer.

    a. Primer: SW, Extreme Bond Interior/Exterior Bonding Primer, B51-150.
    b. Finish Coats: SW, ProMar 200 Zero VOC Latex Semi-Gloss, B31W2650 series.
    **Zero VOC, Anti-Microbial, *Product remains Zero VOC when tinted.*

J. Concrete Masonry Units Eg-Shel Epoxy Finish (EPX): Provide the following epoxy finish systems over filler for wall applications.

1. Eg-Shel Waterbased Epoxy Finish: Two finish coats over a filler.

    a. Filler: PrepRite Block Filler, B25W25.
    b. Finish Coats: Pro Industrial Waterbased Catalyzed Epoxy Eg-Shel, B73-360 series.

K. Previously Painted Concrete Masonry Units Eg-Shel Epoxy Finish (EPX): Provide the following epoxy finish systems over previously painted wall applications. **Note: Mock-Up with adhesion test per ASTM-D3359 is required prior to installation of this system.*

1. Eg-Shel Waterbased Epoxy Finish: Two finish coats over an adhesion promoting primer.

    a. Primer: Extreme Bond Interior/Exterior Bonding Primer, B51-150.

b. Finish Coats: Pro Industrial Waterbased Catalyzed Epoxy Eg-Shel, B73-360.

3.9 MARKERBOARD PAINT

A. Manufacturer: Master Coating Technologies.

B. Products: Wink.

1. Part A: low odor, milky white, nonpigmented liquid emulsion.
2. Part B: pale yellow polymer hardener with slight odor.
3. Wink Surface Conditioner.

C. Characteristics:

1. Fast drying, high gloss, waterbased formula covers in one coat without need for primer.
2. Low Volatile Organic Compound (VOC) content of less than 50 grams per liter.
3. Free of formaldehyde, harmful carcinogens, chromium, lead, and mercury.
4. Class A rated for fire safety in accordance with ASTM E 84.

D. Preparation: Surface should be dry, prepared to Level 5 smoothness, and free of grease, mildew, and any imperfections. Spray application of primers/sealers and base coat of paint preferred. Scuff sanding recommended for high gloss surfaces.

E. Applications: Apply with a roller over smooth, non-porous painted surfaces including drywall, marker board, chalkboard, metal, and glass, as well as smooth vinyl wall covering. Opening, mixing, and installing Wink should be done done by a professional installer, in accordance with the application instructions.

F. Cleaning: For dialing erasing and cleaning use a clean, dry-erase cotton cloth or microfiber towel. Periodically use a clean damp cloth, dry-erase cleaner, or wipes to maintain surface.

G. Warranty: 10-year limited warranty from date of shipment

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Porcelain enamel marker boards with aluminum frames.
2. Vinyl-faced cork tack boards with aluminum frames.
3. Wrapped vinyl-faced cork tack boards (Frameless).
4. Tack strips and display rails with aluminum frames.

1.3 SUBMITTALS

A. Product Data: For each type of visual display board indicated.

B. Shop Drawings: For each type of visual display board required.

1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
2. Include sections of typical trim members.
3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
4. Where occurs, Contractor shall verify the existing board dimensions to ensure new visual display boards cover extent of existing boards.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:

1. Markerboards: Actual sections of porcelain enamel finish for each type of marker board required.
2. Vinyl-Faced Cork Tackboards: Samples for each type of vinyl- faced cork tack board indicated.
3. Tack Strips and Display Rails: Samples for each type of cork required.

D. Product Certificates: Signed by manufacturers of tack boards certifying that vinyl-faced materials furnished comply with requirements specified for flame-spread ratings.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of marker board manufacturer for both installation and maintenance of the type of sliding marker board units required for this Project.

B. Source Limitations: Obtain visual display boards through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the products indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Provide vinyl- and fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl- and fabric-faced tack boards with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 10 or less.

E. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.5 WARRANTY

A. Special Warranties: As follows:

1. Writing Surface: Manufacturer’s standard, written, material warranty agreeing at manufacturer’s option to repair or replace the original boards if they do not retain their original writing and erasing qualities, gloss variance, or color consistency under normal usage and maintenance, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Warranty does not include the cost of removal or reinstallation.

a. Term of Warranty: Limited lifetime warranty.

2. Workmanship and Materials: Manufacturer’s standard, written, material replacement warranty agreeing at manufacturer’s option to repair or replace any products which,

under normal usage and maintenance, show defects in workmanship or materials, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Warranty does not include the cost of removal or reinstallation.

a. Term of Warranty: 10 years from date of Substantial Completion.

PART 1 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Basis of Design:

   a. AARCO

2. Approved Manufacturers:

   a. Claridge Products and Equipment, Inc.

2.2 MATERIALS FOR MARKER BOARD PANELS

A. Writing Surface Facing Sheet: Provide “E-3” surface.

1. Enameling grade cold-rolled steel, manufactured from a minimum of 30 percent post-consumer and post-industrial waste, .016 inch thick for all pre-framed boards without joints. All face sheets shall be .025 inch thick for boards with spline joints and have the same content as .016 inch thick face sheets.

2. Writing surfaces shall consist of the following characteristics:

   a. All coatings shall contain less than a combined total of less than 0.1 percent of heavy metals cadmium, mercury, hexavalent chromium, and lead.
   b. All coatings shall be free of arsenic and antimony as well as volatile organic compounds.
   c. Writing surface face sheet shall be 99 percent recyclable.
   e. Marker board 80 to 85 percent gloss (low-gloss surface), recommended for projection. Wet cleaning required if used as a marker surface.
   f. Facing Sheet Coatings:

      1. Face Coat: 1.7 to 2.5 mils minimum thickness enameled ground coat.
      2. Cover Coat: 3.0 to 4.0 mils enameled color coat.
      3. Back Coat: 1.7 to 2.5 mils enameled minimum ground coat.
      4. Firing Temperatures: 1,475 to 1,500 deg F, minimum.

g. Color(s): As selected by the Architect from the manufacturer's range of standard colors.

B. Writing Surface Core:

1. Core: Minimum 7/16 inch thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
2. Backing Sheet: Manufacturer's standard; moisture-blocking backing, 0.015 inch thick; recyclable; factory-laminated to core material.
3. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

C. Lamination: Factory-machine-type only.

2.3 MATERIALS FOR TACK BOARD PANELS

A. Core: Composed of 100 percent post-consumer and post-industrial waste, or 100 percent naturally-sustainable; 1/4-inch fiberboard laminated to 1/4-inch natural cork.

B. Coverings:

1. 100 percent naturally-sustainable.
2. Covering Materials: Provide the following, as indicated:

a. Framed Tack Boards:
   i. Manufacturer: Carnegie-Xorel
   ii. Series: Meteor.
   iii. Fabric: 16-oz-per-linear-yard, 100% IRP Xorel.
   iv. Backing: X-Protect Wall microvent.
   v. Flammability: ASTM E84 Class A/Class 1.
   vi. Cleaning: Water/Solvent and Bleach Cleanable.
   vii. Width: 52 inches
   viii. Colors: As selected by the Architect from the manufacturer's range of standard colors. Provide a minimum of (80) colors.

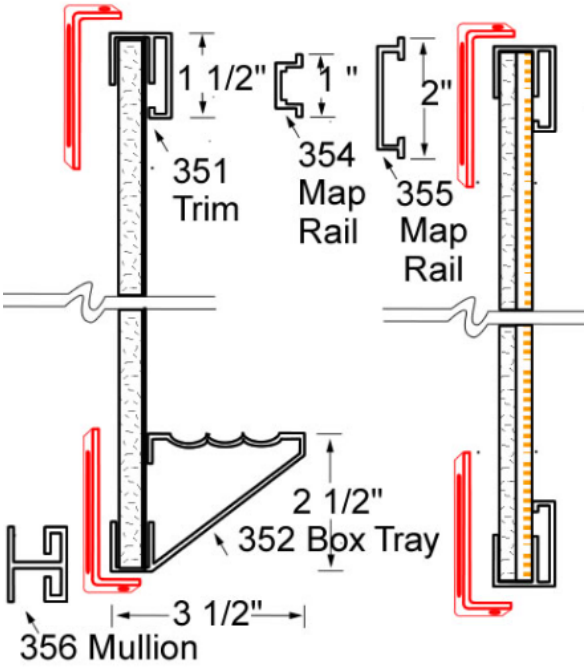
b. Fabric-Wrapped Tack Boards (Frameless):
   i. Manufacturer: Carnegie-Xorel
   ii. Series: Meteor.
   iii. Fabric: 16-oz-per-linear-yard, 100% IRP Xorel.
   iv. Backing: X-Protect Wall microvent.
   v. Flammability: ASTM E84 Class A/Class 1.
   vi. Cleaning: Water/Solvent and Bleach Cleanable.
   vii. Width: 52 inches
   viii. Colors: As selected by the Architect from the manufacturer's range of standard colors. Provide a minimum of (80) colors.

2.5 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Miter corners to a neat, hairline closure.

1. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible fasteners or exposed joints.

   a. Location: All visual display boards unless noted otherwise.
   b. Profile: Aarco, 10-350 RF Series.



2. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

B. Map Rails: Furnish map rail at top of each marker board with rail length equaling length of marker board. In instances where tack boards are located adjacent to marker board, display rail should equal length of marker boards and tack boards. Each display rail on marker boards shall be complete with the following accessories:

1. Display Rail: Provide continuous cork display rail, approximately 2 inches wide integral with map rail.
2. End Stops: Provide one end stop at each end of map rail.
3. Map Hooks: Provide 2 metal map hooks for every 48 inches of map rail or fraction thereof.
4. Flag Holder: Provide one flag holder for each room.
5. Metal Roller Brackets: Provide one pair for each room.

6. Colors: As selected by Architect from manufacturer's full range of colors. Provide a minimum of (15) color selections.

2.6 FABRICATION

A. Porcelain Enamel Marker Boards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Vinyl-faced Cork Tack Boards: Vinyl fabric and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

C. Vinyl-Faced Wrapped Tackboards: Tackboards shall have vinyl fabric tightly wrapped around all edges and securely adhered to the back of the fiberboard. Refer to Drawings for locations.

D. Assembly: Provide factory-assembled marker board and tack board units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

a. Provide marker board lengths of 16'-0" wide maximum with no seams. For boards over 16' – 0", provide butt-joint at seam locations. Refer to drawings for seam locations.

2. Provide manufacturer's standard mullion trim at joints between marker board and tack boards for field-applied trim units.

2.7 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 2 - EXECUTION

3.1 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.

1. Surfaces to receive marker boards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of marker boards.
2. Surfaces to receive tack boards shall be dry and free of substances that would impair the bond between tack boards and substrate.
3. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Field-applied Trim:

1. Deliver factory-built visual display boards completely assembled in one piece without joints, unless noted otherwise. If dimensions exceed panel size, refer to drawings for seam locations. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
2. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

END OF SECTION 101100

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cast and cut out dimensional characters.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work. Include floor plan indicating location of each sign and cross-referencing to the sign schedule information.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at a scale of at least 1 inch equaling 1 foot.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish, in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size or half-size Sample of each type of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

F. Qualification Data: For Installer and manufacturer.

G. Sample Warranty: For special warranty.

H. Maintenance Data: For signs to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

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. In Pro.
2. ASI Sign Systems, Inc.
3. Bayuk Graphic Systems, Inc.
4. Bunting Graphics, Inc.
5. Gemini Incorporated.
6. Metal Arts; Div. of L&H Mfg. Co.
7. Mohawk Sign Systems.
8. 4 Sign Solutions.

B. Cast Characters for Exterior Dimensional Signs: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Character Material: Cast aluminum.
2. Character Height: As indicated on Drawings.
3. Thickness: 1 inch thick, or thicker if determined by manufacturer.
4. Integral Aluminum Finish: Clear anodized (wall mounted signs)
5. Aluminum Finish: Two-Coat Fluoropolymer finish. Color as selected by Architect from manufacturer’s full range of solid colors. (canopy edge signs)
6. Mounting:

a. Wall Surfaces: Projecting studs.

b. Canopy Edges: Surface mounting plate with countersunk screws as detailed on Drawings

7. Typeface: Helvetica, unless otherwise indicated.

C. Cutout Characters for Interior Dimensional Signs: Characters with uniform faces; square-cut, smooth**,** eased edges; precisely formed lines and profiles; and as follows:

1. Character Material: Sheet or plate aluminum.
2. Character Height: As indicated on Drawings.
3. Thickness: 0.25 inch.
4. Integral Aluminum Finish: Clear anodized.
5. Mounting:

a. Bulkhead Edges: Surface aluminum mounting plate with countersunk screws into the top of the bulkhead as detailed on Drawings.

6. Typeface: Helvetica, unless otherwise indicated.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish nonferrous-metal, stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

c. Through Fasteners: Metal fasteners only exposed to non-viewing side of letters, attached to brackets and matching sign finish, with type of head indicated, installed in predrilled holes.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated on Drawings.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated on Drawings.

1. Aluminum Brackets: Aluminum angles, plates or bars, matching finish of letters. Provide in thicknesses and dimensions as indicated, or if not indicated, as required to adequately secure and display letters. Coat surfaces that will be in contact with dissimilar metals with bituminous paint or other method to prevent galvanic action.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated on Drawings and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Angles, Bars and Brackets: Remove loose debris from substrate surface and install angle, bar or bracket supports in position so that signage is correctly located and aligned.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423 – PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Interior Panel Signs.

B. Related Requirements:

1. Division 1 Section "Temporary Facilities & Controls" for temporary Project identification signs.
2. Division 10 Section “Dimensional Signage” for cut metal letters.
3. Division 10 Section “Plaques” for cast aluminum building dedication plaque.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For panel signs, showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, layout, reinforcement, accessories, and installation details.

1. Details: Provide message list for each type of sign required, including typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size. Include large-scale details of nomenclature, including layout of room names, room numbers and graphic symbols, as indicated. Elevation details shall be consistent with sign type number on Drawings.
2. **Floor Plans: Provide floor plans showing locations of each sign, indicating original room name, room number, and sign type.**
3. Signage Schedule: Provide signage schedule in an editable version of Microsoft® Excel® format (.xlsx or .xls) or similar, compatible software. Arrange per building, building floor and building area, in a sequential manner that is consistent with the Drawings. Each room shall consist of a horizontal line of information, which shall intersect with vertical columns, in which applicable information may be input into each cell. Provide the following column heading information, which may be abbreviated as needed, formatted from left to right:
   a. Original Room Number: As indicated on Contract Drawings.
   b. Original Room Name: As indicated on Contract Drawings.
   c. Revised Room Number: Final information to be fabricated; any revisions shall be

input by the Architect.

d. Revised Room Name: Final information to be fabricated; any revisions shall be input by the Architect.
e. Sign Type: To cross-reference Shop Drawing elevation details.
f. Sign Size: To indicate overall sign width and height.
g. Accessibility: To include International Symbol of Access (ISA).
h. Female: To include International Symbol for Female Gender.
i. Male: To include International Symbol for Male Gender.
j. Neutral: To include International Symbol for Gender-Neutral.
k. Family: To include International Symbol for Family.
l. Miscellaneous: To include, and make reference to, additional graphic symbols, including, but not limited to, directional arrows, stairs, and fire, as well as other signage features, such as paper inserts and sliding vacant/in use types.
m. Quantity: Indicate number of same panel sign design required for specific room; provide additional lines for rooms that are to have more than one sign, but require different design or sign type.
n. Remarks: For providing additional notes or remarks; by manufacturer (in black font color), Contractor (in green font color) or Architect (in red font color).

4. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Cast Acrylic Sheet: Manufacturer's color Samples consisting of actual sections or chips of material, including the full range of standard colors, patterns and textures available.
2. Panel Signs: (1) Full-size Sample, not less than 12 inches square, including corners, for verification of basic design.
3. Exposed Accessories: Full-size Sample of each accessory type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate profile and dimensional requirements of panel signs. Slight deviations in profiles and dimensions may be approved, as long as such deviations do not drastically change the design concept, as judged by the Architect. The burden of proof of equality is on the Bidder.

1.7 PROJECT CONDITIONS

A. Field Measurements: Whenever possible, and if necessary, take field measurements prior to the preparation of Shop Drawings and fabrication to ensure proper fitting. Show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.8 WARRANTY

A. When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

1. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

a. Failures include, but are not limited to, the following:

1) Deterioration of finishes beyond normal weathering.
2) Deterioration of embedded graphic image.
3) Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering panel signage products that may be incorporated in the Work include, but are not limited to, the following:

1. 4Sign Solutions.
2. iSigns Inc.
3. Best Manufacturing.
4. Bayuk Graphics.

2.2 FRAMED PANEL SIGNS

A. Cast Acrylic Sheet: ASTM D 4802; non-extruded, non-continuous-cast polymethyl methacrylate monomer (PMMA) or extruded polyvinyl chloride (PVC)-acrylic alloy sheet, Type UVF (UV filtering); in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F, and of the following general types:

1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored, solid acrylic sheet in colors and finishes as selected from the manufacturer's full range of standard colors and textures.
2. Colored Coatings: Use colored coatings, including inks and paints for copy and background colors that are recommended by acrylic manufacturer for optimum adherence to acrylic surface and are non-fading for the application intended.

B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to and compatible with the sign material and mounting surface.

C. Framed Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Construction: Fabricate smooth, flush panel surfaces, capable of remaining flat with no noticeable distortions, while subjected to installed environmental conditions, within a tolerance of plus or minus 1/16 inch, measured diagonally.
2. Laminated Sign Panels: Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process.
3. Engraved Copy: Machine-engrave letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply-formed edges.
    a. Copy Depth: Character, graphic and Braille copy shall be raised 1/32 inch, unless otherwise indicated.
    b. Lettering Style: Upper- and lower-case letters; as selected by Architect from manufacturer’s full range of standard typefaces.
4. Characters and Graphics: Unless otherwise indicated, fabricate signs with 1-inch-high room numbers and 3/4-inch-high room identification lettering. Standard grade Braille shall be located 1/2 inch below copy.
    a. Accessibility Standards: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board’s ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs. All signage shall comply with accessibility requirements, including International Symbol of Access, Braille, and provisions for mounting.
    b. Final room numbering and verbiage designations for all signs shall be approved by Owner prior to fabrication.
5. Edge Condition: Square, non-beveled.
6. Edge Color: Same as background.
7. Frame Material: Plastic
8. Corner Condition: Square, non-rounded.

1. Sign Types: Refer to drawings.
2. Extra Signs: Provide an additional quantity of (5) 8”x8”.

D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

1. Signs shall consist of internationally-adopted graphic silhouette symbols indicating entrances to male, female, gender-neutral, and family restrooms, as well as handicapped-accessibility, where occurs.
2. Provide signs at the entrances of all non-accessible restrooms that graphically indicate the directions to the nearest handicapped-accessible restrooms.

E. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For snap-in changeable inserts beneath removable face sheet, furnish one suction or other device to assist in removing face sheet. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.
2. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert.

2.3 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide colors as selected by the Architect from the manufacturer's full range of standard colors and textures.

1. Manufacturer shall offer no less than (25) colors.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined. Use concealed fasteners and anchors unless indicated to be exposed.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance. All signs shall be mounted per accessibility standards, as required by the authorities having jurisdiction.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods: Attach panel signs to surfaces, as follows:

1. Interior Surfaces: Use one of the following methods, as applicable:

a. Vinyl-covered or Rough Surfaces: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of high-bond adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

b. Smooth Surfaces: Clean bond-breaking materials from substrate surface and remove loose debris. Apply two-face tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Add silicone sealant as needed. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 CLEANING AND PROTECTION

A. Remove protective coverings and strippable films as signs are installed. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until substantial completion.

B. Touch up minor nicks and abrasions; otherwise, remove and replaced damaged or deformed signs that do not comply with requirements.

END OF SECTION 101423

SECTION 101550 TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:
   1. Division 10 Section "Toilet Accessories" for grab bars and similar accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures, except where minimum clear stall dimensions are required.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

   1. Each type of material, color, and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
   2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26.

B. Aluminum Extrusions: ASTM B 221.

C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

D. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.2 SOLID-POLYMER UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products (Santana/Comtec/Capitol) or comparable product by one of the following:

1. Partition Systems Incorporated of South Carolina.
2. Sanymetal; a Crane Plumbing company.

B. Toilet-Enclosure Style: Floor mounted & overhead braced.

C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each as selected by Architect from manufacturer's full range.

D. Urinal-Screen Style: Continuous bracket - wall hung with floor mounted vertical floor bracing post.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):

1. Full height (continuous), clear anodized aluminum.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Clear-anodized aluminum.
2. Hinges: Manufacturer's standard wrap-around paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Floor Mounted & Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Install continuous wall bracket/angle and vertical floor bracing. Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

SECTION 102100 EQUIPMENT SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum horizontal blade equipment screens.

1.02 RELATED SECTIONS

A. Section 051000 – Structural Metal Framing
B. Section 061000 – Rough Carpentry
C. Section 074213 – Metal Wall Panels
D. Section 075323 – EPDM Roofing
E. Section 076000 – Flashings and Sheet Metal
F. Section 079200 – Joint Sealants

1.03 REFERENCES

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.
B. AAMA 2605 – High Performance Organic Coatings on Architectural Extrusions and Panels.
C. AMCA 500-L – Test Methods for Louvers.
D. AMCA 511 – Certified Ratings Program for Air Control Devices.
E. ASCE 7 – Minimum Design Loads for Buildings and Other Structures
F. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
G. ASTM B221 – Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
H. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposure of Paint and Related Coatings.
I. ASTM D4214 – Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films.
J. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
K. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

A. Submit under provisions of Section 013000
B. Product Data: For each product to be used, including:
    1. Manufacturer's product data including performance data.
    2. Installation Instructions
    3. Maintenance and Operations Manuals
C. Shop Drawings
    1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.
D. Samples
    1. Submit color chip sample for units with factory-applied paint.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
    1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
C. Handling: Protect materials and finishes during handling and installation to prevent damage
D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Manufacturer shall provide a standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the owner.
B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on aluminum substrates.
    1. Finish Coating shall not peel, blister, chip, crack, or check.
    2. Chalking, fading, or erosion of finish when measured by the following tests:
        a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
        b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822
        c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.01 MANUFACTURER, provide from, but not limited to the list below:

1. Industrial Louvers Inc. (ILI) - Contact: 511 South 7th Street, Delano, MN 55328; Telephone: (763) 972-2981; Fax: (763) 972-2911.

2.02 EXTRUDED ALUMINUM HORIZONTAL BLADE EQUIPMENT SCREENS

A. Fabrication:
    1. Model: 450XPI
    2. Blades:
        a. Style: Horizontal
        b. Material: Extruded aluminum, 6063-T6
        c. Wall Thickness: 0.081 inch (2.1 mm), nominal
        d. Angle: 40 degrees
        e. Centers: 5 inches (127 mm), nominal
    3. Supports: as required per wind load

2.03 FABRICATION

A. Fabrication Requirements:
    1. Performance: Fabricate as required for optimum performance with respect to strength, durability, and appearance.
    2. Size: Fabricate equipment screens to meet dimensions indicated on Contract Documents.
    3. Field Measurement: Verify size, location, and placement of equipment screens before fabrication.
    4. Shop Assembly:
        a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
        b. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
        c. Clearly mark units for reassemble and coordinated installation.
    5. Accessories: Include supports, anchorages and accessories required for complete assembly.
    6. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.
    7. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.
    8. Connections: Join frame and blade members to one another by mechanical fastener, except where field bolted connections between frame members are made necessary by size of louvers.
    9. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.04 FINISHES (FACTORY)

A. General: Comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by architect.
B. Standard mill finish.
C. Prime Coat:
    1. Apply alkyd prime coat following chemical cleaning and pretreatment.
    2. Primer preparation for field painting
D. Fluorocarbon Two Coat Coating
    1. Coating shall conform to AAMA 2605.
    2. Louvers to be finished with a minimum 1.0 mil (0.025 mm) thick full strength 70% resin, 2 coat Fluoropolymer system.
    3. All aluminum shall be thoroughly cleaned, etched, and given a chromatic conversion pretreatment before application of coating.
    4. Color warranty of 20 years.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean opening 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. Install equipment screens at locations as indicated on the drawings and in accordance with the manufacturer’s instructions.
B. Install equipment screens plumb, level and in alignment with adjacent work.
C. Install joint sealants as specified in Section 07 90 00.

3.04 CLEANING

A. Clean equipment screen surface in accordance with manufacturer’s instructions.
B. Touch-up paint, repair or replace damaged products before Substantial Completion.

SECTION 102123 - CUBICLE TRACKS AND CURTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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. Cubicle curtain tracks and carriers.
2. Cubicle curtains.

B. Related Requirements:

1. Division 6 Section "Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.
2. Division 9 Section "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.3 SUBMITTALS

A. Product Data including durability, fade resistance, and fire-test-response characteristics for each type of curtain fabric specified.

B. Shop Drawings showing layout and types of cubicles, size of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

C. Coordination Drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching cubicle curtain track hangers to building structure.
3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

D. Samples: Contractor shall provide manufacturer’s color PDF images of mesh and curtain fabric for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

E. Schedule of cubicles using same room designations indicated on Drawings.

F. Product certificates signed by manufacturers of cubicle tracks and curtains certifying that their products comply with specified requirements.

G. Maintenance data for cubicle tracks and curtains to include in the operation and maintenance manual specified in Division 1.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify that tracks and curtains may be installed to comply with the original design and referenced standard.

B. Space Enclosure and Environmental Limitations: Do not install tracks and curtains until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, and work above ceilings is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of the Instructions to Bidders, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fabric:

a. Maharam

2. Mesh:

a. ADC Hospital Equipment.
b. Construction Specialties, Inc.
c. Nelson, A.R. Nelson Co., Inc.

2.2 CUBICLE TRACK

A. Track: Anodized, extruded aluminum.

1. Curved Track: Factory fabricated, not less than 12-inch- radius bends.
2. Splicing Clamp: Of same material and finish as track.

B. Track Mounting: Ceiling mounted; mechanically fastened to suspended ceiling grid.

1. Concealed Fasteners: Stainless steel.

C. Track Accessories: Provide end caps, connectors, end stops, coupling sleeves, wall brackets, and other accessories as required for secure and operational installation. Provide a quantity of carriers for 6-inch spacing the full length of the curtain plus 1 additional carrier.

1. Carriers: Nylon rollers and axle with chrome-plated steel hook.

2.3 CUBICLE CURTAINS

A. Fabric: Provide cubicle curtain fabrics with the following characteristics:

1. Fabrics are launderable to a temperature of not less than 160 deg F.
2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

B. Curtain Top: Not less than 20-inch-wide nylon mesh with 1/2-inch-diameter holes. Overlap seams and double-lock stitch to body of curtain.

C. Provide curtains fabricated to comply with the following requirements:

1. Width: Equal to track length from which curtain is hung plus 10 percent, but not less than 12 inches.
2. Length: Equal to floor-to-ceiling height minus 18 inches from finished ceiling at top and 12 inches above finished floor.
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double stitched.

    a. Grommets: 2-piece, rolled-edge, rustproof, nickel-plated brass and spaced not more than 6 inches o.c.

4. Bottom and Side Hems: Not less than 1 inch wide, reinforced, triple thickness, and single stitched.
5. Seams: Not less than 1/2 inch wide, double turned and double stitched.

D. Curtain Drop: PVC strip with chrome-plated steel hook.

E. Curtain Tieback: At each termination.

F. Operating Wand: Fiberglass baton, not less than 30 inches long.

G. Cubicle Curtain Fabrics:

1. Manufacturer: Maharam.
2. Pattern: Ascend
3. Color: As selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ceilings for suitable conditions where cubicle track is to be installed.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cubicle curtain track level and plumb, according to manufacturer's written instructions and original design.
B. Install ceiling-mounted tracks at intervals of not less than 24 inches. Coordinate track installation with ceiling grid and lighting fixtures.

C. Install suspension-mounted tracks at intervals of not more than 48 inches. Secure ends of track to wall with flanged fittings. Fasten at each splice and the tangent point of each corner.

D. Center fastener in track to insure unencumbered carrier operation.

3.3 PROTECTION

A. Protect installed track opening with a non-residue adhesive tape to prevent debris from the ceiling finishing operation from impeding carrier operation.

END OF SECTION 102123

SECTION 102238 – OPERABLE PANEL PARTITIONS

PART 1: GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Manually operated, individual panel operable partitions.

B. Related Sections include the following:

1. Division 03 Sections for concrete tolerances required.
2. Division 05 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
3. Division 06 Sections for wood framing and supports, and all blocking at head and jambs as required.
4. Division 09 Sections for wall and ceiling framing at head and jambs.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions.*

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.4 REFERENCE STANDARDS

A. ASTM International
1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
3. ASTM E84 - Surface Burning Characteristics of Building Materials.

4. ASTM E413 - Classification for Rating Sound Insulation

B. Health Product Declaration Collaborative
   1. Health Product Declaration Open Standard v2.1

C. International Standards Organization
   1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
   2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
   3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
   4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
   5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards
   1. ADA – Americans with Disabilities Act

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating glass thickness and spacing in test specimen matches product as submitted.

F. Create spaces that are healthy for occupants.

   1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.

   1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

H. Buy American: Folding door to be manufactured in the United States in compliance with applicable U.S. Federal Trade Commission (FTC) and U.S. Customs Service and Border Protections regulations and be labeled "Made in America".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Partition Warranty period: Three (3) years.

C. Suspension System Warranty:

1. Existing Lobby 123, OH-01: Five (5) years.

2. Lobby 115, OH-02 (1/2 Wall): Five (5) years.

3. Lobby 115, OH-03 (1/2 Wall): Five (5) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Modernfold, Inc.

B. Doors to be manufactured in the U.S.A.

C. Products: Subject to compliance with the requirements, provide the following product:

1. Acousti-Seal Encore - Single Panel: Manually operated individual panel operable partition.

2.2 OPERATION

A. Acousti-Seal Encore - Single Panel: Series of individual flat panels, manually operated, top supported with operable floor seals and automatic top seals.

B. Final Closure:

1. Horizontally expanding panel edge with removable crank

2.3 PANEL CONSTRUCTION

A. Nominal 4.25-inch (108mm) thick panels in manufacturer's standard 51-inch (1295mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel skin shall be:

   1. Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:

      a. 54 STC

C. Hinges for Closure Panels, Pass Doors, and Pocket Doors shall be:

   1. Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:

   1. 54 STC - 9.5 lbs./square foot

2.4 PANEL FINISH

A. Panel finish shall be factory applied, Class "A" rated material. Finish shall be:

   1. Reinforced vinyl with woven backing weighing not less than 20 ounces (567 grams) per lineal yard.

B. Panel Trim: Exposed panel trim of one consistent color:

   1. To Be Advised

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Aluminum astragals, with tongue and groove configuration in each panel edge. Rigid plastic astragals are not acceptable.

B. Horizontal Top Seals shall be Modernfold SureSet™ automatic operable top seals, manually operated top seals not required or permitted.

C. Horizontal bottom floor seals shall be Modernfold Sureset™ bottom seal:

1. Modernfold SM2 Bottom Seal. Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (54 kg) downward force to the floor throughout operating range.

2.6 SUSPENSION SYSTEM

A. #17 Suspension System - “Smart Track™”

1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.

   a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2. Carriers: Two all-steel trolleys with steel tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

2.7 OPTIONS

A. Available accessories/options:

B. Single Pass Doors:

1. Lobby 115 OH-02 (1/2 Wall): Matching pass door same thickness and appearance as the panels. ADA compliant pass door equipped with friction latch and flush pulls for panic operation. No threshold will be permitted. Self-Illuminated exit signs.

1. Lobby 116, OH-03 (1/2 Wall): Matching pass door same thickness and appearance as the panels. ADA compliant pass door equipped with friction latch and flush pulls for panic operation. No threshold will be permitted. Self-Illuminated exit signs.

1. Existing Lobby 123, OH-01: Matching pass door same thickness and appearance as the panels. ADA compliant pass door equipped with friction latch and flush pulls for panic operation. No threshold will be permitted. Self-Illuminated exit signs.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer’s written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION 102238

SECTION 102641 BULLET RESISTANT PANELS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes bullet resistant fiberglass panels.

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM E119-98 Standard Test for One-Hour Fire-Rating of Building Construction and Materials
B. International Organization for Standardization:
   1. ISO 9001:2015 Quality Management System
C. Small Business Administration:
   1. SBA Small Business Size Standard
D. Underwriters Laboratories:
   1. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006, Level 1
E. The United States Department of State:
   1. The International Traffic in Arms Regulations (ITAR)

1.3 SUBMITTALS

A. Submittals for Review: Submit for approval prior to fabrication.
   1. Product Data: Include specifications, brochures, and samples.
   2. Recommendations for installation of Bullet Resistant Fiberglass Panels available in print document and video link.
B. Certificates: Submit printed data to indicate compliance with following requirements.
   1. UL LISTING Verification and UL752 Current Test Results as provided by Underwriters Laboratories.
   2. ASTM E119-98 One-Hour Fire Rating of Building Construction and Materials.
   3. Manufacturer's third party certificate of registration with ISO 9001:2015.
   4. Manufacturer's U.S. Dept. of State ITAR Statement of Registration.
   5. Manufacturer's SBA Profile verifying small business status by the SBA.

1.4 DELIVERY, HANDLING, AND STORAGE

A. Deliver materials to project with manufacturer's UL LISTED Labels intact and legible.
B. Handle material with care to prevent damage. Store materials inside under cover, stack flat and off the floor.

1.5 WARRANTY

A. Warrant all materials and workmanship against defects for a period of ten (10) years from the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Design Basis: Contract Documents are based on ArmorCore by Waco Composites, (Waco, TX 76710, phone: 254-752-3622, toll free: 866-688-3088, email: sales@armorcore.com, web: www.armorcore.com)

2.2 PERFORMANCE CRITERIA

A. Bullet Resistant Fiberglass Panels shall be “non ricochet type” to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
B. Panel Rating: UL752 Level 1.
C. Bullet resistance of joints: equal to that of the panel.

2.3 MATERIALS

A. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
B. Thickness: 1/4” nominal thickness
C. Nominal Weight: 2.6 lbs. per sq. ft.
D. Panel Size: 5’ x 10’
E. Panels manufactured in the United States of America with raw materials sourced from the U.S.A. for quality assurance purposes and to comply with any applicable “Buy American” provisions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting installation, verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence.

3.2 JOINTS

A. Reinforce joints with a back-up layer of bullet resistive material. Minimum width of reinforcing layer at joint shall be 4-inches, centered on panel joints.

3.3 APPLICATION

A. Install armor in accordance with manufacturer’s printed recommendations and as required by contract documents.
B. Secure armor panels using screws, bolts, or an industrial adhesive.

1. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

END OF SECTION 102641

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Semi-recessed fire extinguisher cabinets for portable fire extinguishers.

B. Related Sections include the following:

1. Division 10 Section “Fire Extinguishers” for portable fire extinguishers installed in fire extinguisher cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher cabinets.

1. Fire Extinguisher Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire extinguisher cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire extinguisher cabinets. Coordinate final fire extinguisher cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

D. Maintenance Data: For fire extinguisher cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section “Project Meetings”.

1. Review methods and procedures related to fire extinguisher cabinets including, but not limited to, schedules and coordination requirements.

1.5 COORDINATION

A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire extinguisher cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B209.
2. Extruded Shapes: ASTM B221.

C. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm or 6 mm thick, with Finish 1 (smooth or polished).

D. Acrylic Bubble: One piece.

2.2 FIRE EXTINGUISHER CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. J. L. Industries, Inc., a division of Activar Construction Products Group.
b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
c. Larsen's Manufacturing Company.
d. Potter Roemer LLC.
e. Watrous Division, American Specialties, Inc.

B. Cabinet Construction: Non-rated type, to only be installed in nonrated walls.

C. Cabinet Material: Aluminum sheet on exterior, aluminum or steel sheet on interior.

D. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.

1. Edge Trim: Either square-edge trim with 1-1/4- to 1-1/2-inch backbend depth, or rolled-edge trim with 2-1/2-inch to 4-1/2-inch backbend depth.

E. Cabinet Trim and Door Material: Aluminum sheet.

F. Door Style: Full bubble with frame.

G. Door Glazing: Molded acrylic bubble.

1. Acrylic Bubble Color: Clear transparent acrylic sheet.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action or friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire extinguisher cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

a. Identify fire extinguisher in fire extinguisher cabinet with the words "FIRE EXTINGUISHER" applied to cabinet glazing.

1) Application Process: Silk-screened or pressure-sensitive vinyl letters.
2) Lettering Color: Red.
3) Orientation: Vertical.

J. Finishes:

1. Manufacturer's standard baked-enamel paint for the interior of cabinet**.**
2. Aluminum Trim and Doors: Clear anodic.

2.3 FABRICATION

A. Fire Extinguisher Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire extinguisher cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire extinguisher cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.6 STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire extinguisher cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire extinguisher cabinets in locations and at mounting heights indicated, in compliance with requirements of authorities having jurisdiction.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire extinguisher cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire extinguisher cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire extinguisher cabinets, square and plumb.

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire extinguisher cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire extinguisher cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire extinguisher cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire extinguisher cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire extinguisher cabinet and mounting bracket manufacturers.

E. Replace fire extinguisher cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 – FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections include the following:

1. Division 10 Section "Fire Extinguisher Cabinets" for semi-recessed fire extinguisher cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product specified. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

C. Warranty: Sample of special warranty.

D. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE FIRE EXTINGUISHERS

A. Fire Extinguishers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. JL Industries
b. Amerex Corporation
c. Badger Fire Protection.
d. Buckeye Fire Equipment
e. Kidde – A UTC Fire & Security Company

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. **Type FE-1** Multipurpose Dry-Chemical Type: UL-rated 2A–10B:C, 5 lb. nominal capacity, with a specially fluidized and siliconized mono ammonium phosphate-based dry chemical in manufacturer's standard enameled container.

1. All locations except as noted otherwise.

C. **Type FE-2** Wet Chemical Type: UL-rated 2A–10B:C:K, 6 liter nominal capacity, in a stainless steel container.

1. For use at locations in the Concession and services areas.

D. **Type FE-3** Dry-Chemical Type: C02 Type CD 10. UL-rated 2A-10B:C, 10 lb. carbon dioxide nominal capacity in manufacturer's standard enameled container.

1. For use in the Electrical/Mechanical Room and Data Closets.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard “J-type” galvanized steel hook, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red black baked-enamel finish. Mobile-style clamp brackets are prohibited.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction and the latest version of NFPA 10 and ADAAG.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.3 INSPECTION

A. New fire extinguisher units shall be inspected and/or serviced by a certified (NAFED) extinguisher contractor prior to installation. An inspection tag, displaying the current year, shall be attached to the unit before installation.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Knocked-down corridor student lockers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.
2. Locker benches.

F. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in 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. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Locks.
b. Blank identification plates.
c. Hooks.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver combination control charts to Owner by registered mail or overnight package service.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
B. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide metal locker and bench products of each type as manufactured by Penco Products, Inc. or comparable products by one of the following:

1. Lyon Workspace Products, LLC
2. Republic Storage Systems, LLC

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 KNOCKED-DOWN CORRIDOR STUDENT LOCKERS

A. Types:

1. Single tier staff lockers; 18-inch W x 18-inch D x 32-inch H.

B. Basis-of-Design Product: Penco – Guardian locker with recessed pocket and louvered door.

C. Doors: One piece; fabricated from 0.060-inch nominal-thickness (16 gauge) steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier lockers.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 48 inches high.

G. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks; positive automatic latching and prelocking.

a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

H. Locks: Built-in recessed latch to receive padlock by others

I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

J. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.

K. Coat Rods: Manufacturer's standard.

L. Continuous Flat Tops: Fabricated from 16 gauge nominal-thickness steel sheet.

1. Closures: Vertical-end type.
2. Sloping-top corner fillers, mitered.

M. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

N. Filler Panels: Fabricated from 0.036-inch nominal-thickness steel sheet.

O. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

P. Center Dividers: Fabricated from 0.024-inch nominal-thickness steel sheet.

Q. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

R. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers using manufacturer's nuts, bolts, screws, or rivets.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

G. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

I. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

J. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

K. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach flat-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 1073000 - TRANSLUCENT FIBERGLASS SANDWICH PANEL STRUCTURAL CANOPY SYSTEM SPECIFICATION

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the structural canopy system as shown and specified. Work includes providing and installing:

1. Structural aluminum box beam superstructure
2. Factory prefabricated structural insulated translucent sandwich panels
3. Aluminum installation system

B. Related Sections:

1. **<Insert Related Sections>**

1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.

B. Submit shop drawings. Include plans, elevations and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory finished exposed aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below.

a. Sandwich panels**:** 7" x 12" units
b. Factory finished aluminum: 3" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:
a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
b. Burn Extent (ASTM D 635)
c. Color Difference (ASTM D 2244)

d. Impact Strength (UL 972)
e. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
f. Bond Shear Strength (ASTM D 1002)
g. Beam Bending Strength (ASTM E 72)
h. Insulation U-Factor (NFRC 100)
i. Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure (ASTM E2707)
j. Fall Through Resistance (ASTM E 661)
k. Class A Roof Covering Burning Brand (UL 790)

1.3 CLOSEOUT SUBMITTALS

A. Provide project maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Single Source: Obtain primary and secondary components and structural framing members, translucent fiberglass roof panels, clips, closures, and other accessories from a single manufacturer to operate as a complete system for the intended use.

C. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete canopy system, including the aluminum box beam superstructure.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Structural Loads; Provide canopy system capable of handling the following loads:

a. Roof Live Load, on horizontal projected surface: Factored per applicable building code

b. Roof Snow Load, on horizontal projected surface: Factored per applicable building code

c. Roof Snow Drift Load, on horizontal projected surface; Factored per applicable building code

d. Base Wind Load Factored per applicable building code

B. Deflection Limits:

1. Canopy Panels: Limited to l/60 of clear span.

C. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver canopy system, components and materials in manufacturer’s standard protective packaging.

B. Store canopy system panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer’s storage and handling instructions.

1.7 WARRANTY

A. Provide manufacturer's and installer's written warranty agreeing to repair or replace canopy system work, which fails in material or workmanship within Five (5) years from the date of delivery. Failure of material or workmanship shall include deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Structures Unlimited, Inc. Other manufacturers may bid this project subject to compliance with the performance requirements of this specification and submission evidence thereof. Listing other manufacturers’ names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Structures Unlimited, Inc., Tel: (800) 225-3895 – Fax: (603) 627-0798 – Email: info@structuresunlimitedinc.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.
2. Interior face sheets:
   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 10 and smoke developed no greater than 350-400 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1".
3. Exterior face sheets:
   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 3 years outdoor South Florida weathering at 5° facing south, as measured on a white sample with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
   b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by handheld pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
   c. Erosion Protection: Integral, embedded-glass erosion barrier.
4. Appearance:
   a. Exterior face sheet: Smooth, .070" thick and **White** in color.
   b. Interior face sheet: Smooth, .045" thick and **White** in color.
   c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. **Aluminum** I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 1", thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".

2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

    a. 50% Relative Humidity at 68° F: 540 PSI
    b. 182° F: 100 PSI
    c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
    d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: **2-3/4"**
2. Light transmission: **23%**
3. Solar heat gain coefficient: **0.30**
4. Panel U-factor by NFRC certified laboratory: **0.53**
5. Grid pattern: Nominal size **8"x20"**; Pattern: **SHOJI**

B. Standard panels shall deflect no more than 1.9" at 30 PSF in 10'-0" span without a supporting frame by ASTM E 72.

C. Panels shall meet the conditions of acceptance according to ASTM E2707 Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure:
1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 60-min observation period.
3. Absence of evidence of flame, glow, and smoke if the test is terminated prior to the completion of the 60-min observation period.

D. Canopy System:

1. Roof system shall pass Class A Roof Burning Brand Test by UL 790.

E. Canopy System shall meet the fall through requirements of OSHA 1910.21 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system: Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

B. Sealing tape: Manufacturer’s standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: Various series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be **selected from manufacturer's standards.**

2.5 SUPERSTRUCTURE

A. The superstructure shall be pre-fabricated of extruded aluminum alloy 6005-T5, 6005A-T61 or 6061-T6 box beams. Ferrous metals shall not be allowed. All parts shall be pre-assembled at the factory and knocked down for shipment. System shall be a rigid frame design.

B. Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be **selected from manufacturer's standards.**

C. Aluminum structural system design and calculations must be furnished in accordance with the Aluminum Association “Specifications for Aluminum Structures” and the applicable building code. Design calculations must be prepared and stamped by a Licensed Professional Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with structural canopy installation until unsatisfactory conditions have been corrected by the general contractor.

3.2 PREPARATION

A. Metal Protection:

1. The general contractor shall prepare foundations, piers, curbs, footings and/or lintels isolating dissimilar materials from aluminum system, which may cause electrolysis.

2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

3. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

B. The general contractor shall install foundations, piers, curbs, footings and/or lintels designed to withstand the thrust generated by the canopy.

C. The general contractor shall provide temporary enclosures if required.

3.3 INSTALLATION

A. Install the canopy system in accordance with the manufacturer's installation recommendations and approved shop drawings.

B. After other trades have completed work on adjacent material, carefully inspect translucent panel installation and make adjustments necessary to ensure proper installation.

3.4 CLEANING

A. Refer to manufacturer's written recommendations.

END OF SECTION 088300

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.
3. Motor-operated roller shades with double rollers.

B. Related Requirements:

1. Division 6 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Division 7 Section "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
3. Division 26 Section “Electrical” for electrical supply, conduit, and wiring for motorized window shades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basic of Design:

a. Draper Inc., Manual Flexshade.
b. Draper Inc., Motorized Flexshade.

2. Approved Manufacturers:

a. Jacksons Window Shoppe.
b. Hunter Douglas Contract.
c. Levelor Commercial.
d. MechoShade Systems, Inc.
e. SWF Contract.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated. Manufacturer's standard which must comply with ANSI/WCMA A100.1, American National Standard for Safety of Corded Window Covering Products.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-filtering Series.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material
b. Color and Finish: As selected by Architect from manufacturer's full range of colors.

E. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

    a. Shape: L-shaped
    b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Back Covers for Roller Shades at Interior Windows: Provide and install back cover for all interior shades.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

F. Location: Shades to be applied to exterior applications as indicated on the Drawings; refer to reflected ceiling plans.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include line-wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

    a. Electrical Characteristics: 110-V ac

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    a. Individual/Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
    b. Color: As selected by Architect from manufacturer's full range.

4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.

5. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: [Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Adhesive strip.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

E. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.

3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include line-wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

a. Electrical Characteristics: 110-V ac

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    a. Individual/Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
    b. Color: As selected by Architect from manufacturer's full range.

4. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.

1. Double-Roller Mounting Configuration: Offset, outside shade over and inside shade under.
2. Inside Roller:

    a. Drive-End Location: Right side of interior face of shade.
    b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

3. Outside Roller:

    a. Drive-End Location: Right side of interior face of shade.
    b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

4. Shadeband-to-Roller Attachment: Adhesive strip.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Inside Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

E. Outside Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.

b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.

3. Endcap Covers: To cover exposed endcaps.

4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

F. Location: 129 Multi-Purpose, 201 Upper Commons, refer to reflected ceiling plans.

2.5 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Mermet, T-Screen.
2. Type: PVC Coated polyester.
3. Weight: 13.83 oz per yard.
4. Openness Factor: 1 percent.
5. Color: As selected by Architect from manufacturer's full range of colors.

C. Blackout Fabric: Woven fabric, stain and fade resistant.

1. Source: Indiana Coated Fabrics (ICF), Apagon Style III
2. Type: Fiberglass textile with PVC film bonded to both sides.
3. Weight: 12.8 oz per square yard
4. Color: As selected by Architect from manufacturer's full range. Provide a minimum of (8) color selections.
5. Location: Refer to drawings.

2.6 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F.

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Hardware shall be mounted to jamb or head of window opening. Mounting to the frame is NOT approved.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123216 – EDUCATIONAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Division 0 - Bidding and Contract Requirements and Division 1 General Requirements apply to this Section.

1.2 SCOPE OF WORK

A. Provide all plastic laminate casework and related accessory items as specified herein. Refer to contract documents for specific details and requirements. Casework includes all storage components, accessory items, closure, fillers, and framing necessary for a complete installation, as identified by manufacturers product/model number, or reference thereto.

B. All casework within science laboratory and prep rooms shall receive epoxy countertops and backsplashes, as further described herein.

C. Specialty product systems as indicated by product designation within contract documents shall include, but not limited to: Steel framed island assemblies, steel framed technology clusters, adjustable and re-locatable casework and computer modules.

D. General Conditions: The General Conditions, Supplementary General Conditions, Special Conditions, and General Requirements apply to all work in this Division.

E. Provide coordination with Mechanical and Electrical contractors for their respective installation of mechanical and electrical fixtures.

1.3 RELATED REQUIREMENTS

A. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling and that are concealed within other construction before paneling installation.

B. Division 6 Section “Interior Architectural Millwork” for general millwork and custom cabinetry unless specified herein or so noted on plans as included within this section.

C. Division 9 Section “Resilient Base and Accessories” for resilient base applied to laboratory casework.

D. Division 12 Section “Simulated Stone Fabrication” for solid surface countertops/backsplashes and transaction ledges.

E. Division 22, 23, 26 for sinks, faucets, fittings, traps, stops, tail pieces, vacuum breakers, and other fixtures, electrical and mechanical runs and connections.

F. Fixture installation/services connections: Setting and installation of equipment and fixtures, and related utility connections, are provided under the other sections of the Project Specification governing the utility.

1.4 SUBMITTALS

A. Submit in accordance with General, Supplementary, and Special Conditions.

B. Submit shop drawings for approval in the form of one reproducible sepia and one print. Show materials, dimensions, cabinet-cut details, and sink locations.

C. Samples: Contractor shall provide manufacturer's color PDFs of images of plastic laminate manufacturers for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer. Architect to have color choice from full range of laminates, including premium series.

D. QUALIFICATIONS

A. Case System is used to establish a standard of quality subject to compliance with requirements, of the Instructions to Bidders. Products that may be incorporated in the work include:

1. Case Systems.
2. Mastercraft.
3. TMI Systems Corporation.
4. Stevens Advantage Cabinet Systems.
5. Kerkau (as indicated on drawings).
6. Hann Manufacturing (as indicated on drawings).

B. Manufacturers shall submit evidence of at least 5 years experience and installations for similar type of project.

C. Manufacturers shall submit certified product test data in accordance with ANSI A161.1-1980, NEMA LD3-1991, and general static load testing performed and certified by an independent testing agency, covering the following areas of product performance, with these minimum results.

1.	Base cabinet construction/racking test:	800 lbs.
2.	Cabinet front joint loading test:	425 lbs.
3.	Wall cabinet static load test:	2,200 lbs.
4.	Drawer front joint loading test:	600 lbs.
5.	Drawer construction/static load test:	635 lbs.
6.	Cabinet adjustable shelf support device/static load test:	300 lbs.
7.	Particleboard screw holding power:	350 lbs.

D. The following performance details are project requirements and must be met by all Bidders whether named herein, or approved by Addendum. Deviations will not be allowed.

1. Design:

a. All Casework: Case Systems used to establish a standard of quality. Standard

Reveal Overlay Cabinet door design with door/drawer front edge having 3mm PVC and cabinet body edge having Flat Edge PVC.

2. ADA-Americans with Disabilities Act Requirements: The special requirements specified herein shall be met, where specifically indicated on architectural plans as "ADA", or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations.
3. Lamination System: Doors, finished end panels, and other decorative exterior laminate surfaces shall be composed of minimum 3/4 inch core, laminated exterior with .030 inch high pressure plastic laminate, and interior with .020 inch high pressure cabinet liner. Lamination with hybrid P.V.A. Type III water resistant adhesives. Total thickness 13/16 inch. No exceptions.
4. Structural Cabinet Body: Cabinet backs shall be minimum 3/8 inch thick, inset from rear of body, fully housed four sides, and back-shimmed. Provide 3/4 inch thick stiffeners glued and fastened to back/body as specified herein. Back perimeter and stiffeners to be fully sealed with hot melt adhesive.
5. Interior Space: All cabinets shall have clear span interiors. No vertical dividers allowed unless by specified architectural design.
6. Heavy Components: Wall cabinet tops and bottoms, and all bookstack shelves shall be minimum 1 inch thick, for additional load support. Shelves in door cabinets 30 inches wide and over shall be 1 inch thick. Shelves in open cabinets, regardless of width, shall be 1 inch thick.
7. Structural Drawer Body: Drawer body material shall be multi-directional fiberboard with bottom recessed, captured all four sides and sealed with hot melt adhesive. Provide under body stiffener as specified herein. Particleboard bodies and/or surface-applied bottoms are not acceptable.
8. Drawer Suspension: Drawer slides shall be self-closing design, epoxy power-coated, with positive instop, outstop, and out-keeper. Kynamic (operational) load rating to be minimum 100 lbs. Minimum 150 lb. static load rating.
9. Structural Cabinet Support: Cabinet sub base shall be of a separate and continuous ladder-type platform design leveled and floor mounted prior to cabinet body replacement. Material to be exterior grade plywood. No cabinet sides-to-floor will be allowed.

E. Architect/Owner's opinion and decision shall be final in the evaluation of manufacturer's products for approval to bid or award of contract.

F. Guarantee: All materials produced by the Casework Manufacturer shall be guaranteed for a period of five years from manufacturer’s defects and workmanship. Other materials and equipment shall carry the Guarantee of the product manufacturer.

PART 1 - PRODUCTS

1.1 MATERIALS

A. Laminated Plastics/Finishes:

1. High pressure plastic laminate, .030 inch thickness, for exterior cabinet surfaces shall meet NEMA LD3-1991 GP28 standards including thickness.

2. Exterior Color Selection Available:

    a. Vertical surface laminate finish, standard and premium, from manufacturer's full range of colors consisting of solid colors, patterns and wood grains. Provide a minimum of (125) laminates.
    b. Total of 6 different colors available per project.
    c. Manufacturers: Laminates to be selected from a combination of the following laminate manufactures.

        1. Wilsonart.
        2. Formica.
        3. Pionite.
        4. Nevamar.

3. Plastic Laminate Balancing Sheet: White high pressure cabinet liner, .020 inch thickness shall meet NEMA LD3-1991 CL 20 standards. Use for balancing exterior surface laminates.

4. Countertop High Pressure Plastic Laminate:

    a. High pressure plastic laminate, textured finish .050 inch thickness or .042 inch postforming grade as detailed. Color as selected from manufacturer's full range of laminate patterns and colors.
    b. Heavy gauge neutral colored backing sheet for balanced construction.

5. Pressure Fused Laminate/Interior Surfacing:

    a. Melamine resin impregnated, 100 gram PSM minimum, surface laminated to core under pressure.
    b. Shall meet NEMA LD3.1-1991 GP28 standards and NEMA LD3-1991 CL20 standards.
    c. White pressure fused laminate for cabinet interiors behind door and drawers and underside of wall cabinet unless otherwise specified. Interiors of all open cabinets are to be HPL.
    d. Shall be balanced at all concealed surfaces with phenolic backer. Unsurfaced coreboard not allowed.

B. High Performance Particle Board Core:

1. Particleboard to be 47 lb. density, of balanced 3-ply construction with moisture content not to exceed 8%. Particleboard shall conform to ANSI A208-1-1993, Type M-3.
2. Particleboard cabinet components to be of the following minimum core thickness prior to lamination:

    a. 3/8" cabinet backs.
    b. 1/2": dividers, as detailed.
    c. 3/4": base and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, door, drawer head, cabinet back rear hang strips, dividers as detailed, exposed cabinet backs.
    d. 1": wall cabinet tops and bottoms, door-cabinet shelving 30 inch width and over, exposed cabinet shelving and off-wall shelving of all widths.

C. Edging Types: Provide one or more of the following in accordance with Paragraph 2.1.D, "Edging Locations":

1. 3mm thick PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, automatically trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design.
2. Flat Edge PVC, .020 inch. Solid, high impact, purified, color-thru, acid resistant PVC edging machine-applied with hot melt adhesives, automatically trimmed face, back, and corners for uniform appearance.

D. Edging Locations:

1. Edging locations on ALL Casework: provide edging types at the following locations:

   d. Door/Drawer-Front edging shall be 3mm PVC selected by Architect from manufacturer's full range of colors. Provide a minimum of (52) colors.
   e. Cabinet Body edge, including door/drawer front spacer rail shall be flat edge PVC, color matched to door/drawer face.
   c. Interior body component edging, interior dividers, drawer body, shelf shall be FlatEdge PVC to match cabinet interior surface color, white.

E. Hardware:

1. Hinges:

   a. Heavy duty, five knuckle 2 3/4 inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, tight pin feature with all edges eased. Hinge to be full wrap around type of tempered steel .095 inch thick. Each hinge to have minimum 9 screws, #7, 5/8 inch FHMS to assure positive door attachment.
   b. One pair per door to 48 inch height. One and one-half pair over 48 inch in height. Hinge to accommodate 13/16 inch thick laminated door and allow 270 degree swing.
   c. Finish to be LH-301 ChromeCoat Powder Finish.

2. Pulls: Wire design, LH-325 nylon, 4 inch; in Brushed Chrome.
3. Drawer Slides:

   a. Standard Drawers: LH-376, self-closing design. White epoxy powder coated with positive in-stop, out-stop, and out-keeper to maintain drawer in 80% open position. Captive nylon rollers, front and rear. Minimum 100 lb. dynamic load rating at 50,000 cycles. Minimum 150 lb. static load rating.
   b. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
   c. Student Island Assembly Drawers, Full extension, 3-part progressive opening slide, minimum 100 lb. Zinc plated or epoxy coated at manufacturer's option.
   d. File Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb. zinc plated or epoxy coated at manufacturer's option.
   e. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer's model number

4. Catches: Catch to provide opening resistance in compliance with the Americans with Disabilities Act.

a. Provide one top-mounted magnetic catch for base, wall and tall cabinet door. Catch housing to be molded in White. LH-340ADA.
b. LH-345 Roller catch for mobile cabinets.

5. Adjustable Shelf Supports: To be LH-354 twin pin design with anti tip-up shelf restraints for both 3/4 inch and 1 inch shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum 300 lbs. each support without failure, reference 1.4.D. Cabinet interior sides shall be flush, without shelf system permanent projection.

6. Wardrobe Rod: To be 1 1/16 inch rod, LH-362, supported by LH-363 flanges.

   a. Note: Wardrobe Rods shall be adjustable with mounting at 48 inches and 72 inches A.F.F. to the center of the rod.

7. Locks: To be disc tumbler lock keyed alike per room and master keyed. Dull chrome finish.

   a. Hinged doors and drawers National Lock No. M4-7054.

8. Coat Hooks: Note Coat Hooks are to be mounted to the casework at 48 inches A.F.F. to the center of the hook.

   a. Double Coat Hooks, ceiling mount - Satin Aluminum
   b. Single Coat Hooks, ceiling mount - Satin Aluminum
   c. Double Coat hooks, wall mount - Satin Aluminum
   d. Single Coat Hooks, wall mount - Satin Aluminum

9. Wheel Casters:

   a. Casters for low mobile units to be LH-390 4 inch x 1 1/16". Minimum 275 lb. Load rating per caster. Wheel brakes on front two casters.
   b. LH-386 swivel casters for standard mobile cabinets shall be plate type caster with ball bearing swivel. Size shall be 5 inches for tall mobiles, with 1 1/16 inch wide tread for carpet or hard cover floor. Wheel brakes on front two casters. Minimum 300 lb. load rating per caster.

10. Mobile Steel Frame Structure:

    a. Low mobile cabinets shall be designed with a structurally layered base to which above specified plate-type casters are bolted.

11. Molded Personal Pencil Drawer: High-Impact, Medical Grade Polystyrene, FDA approved, with in-stop, out-stop, and self closing features. Compartmented drawer body molded in Black with Black epoxy coated metal slides. Provide where indicated by product designation on plans or as scheduled.

12. Cable Trays: Unless otherwise specified, cable trays shall be 6 inches high x 4 inches deep returned vertically 3 inches. Cable trays shall be of 16 gauge steel with hemmed return, or high impact Styrene with reinforced exist-ends, Black. When so designated by architectural detail, or product number designation, cable trays shall include integral seven plug grounded duplex electrical strip with surge protector, and 6 foot three wire cord/socket.

13. Padlock Hasp: Zinc, two-piece, non-hinged hasp.

14. Grommets: For cable passage through countertops; 1-1/4-inch outside diameter molded-plastic grommets and matching plastic caps with slot for wire passage. Provide standard color selections: Black, Almond, Grey or White.

1.2 CONSTRUCTION

A. Detailed Requirements for Cabinet Construction

1. Sub-Base:

a. Cabinet Sub-Base: To be separated and continuous (no cabinet body sides-to-floor), water resistant exterior grade plywood with concealed fastening to cabinet bottom. Ladder-type construction of front, back and intermediates to form a secure and level platform to which cabinets attached.
b. Tubular steel 1 1/4" square base in brushed chrome, or black, furnished where specified.

2. Cabinet Top and Bottom:

a. Solid sub-top to be furnished for all base and tall cabinets.
b. Wall cabinet and library stack bottoms and tops to be 1 inch thick.
c. Exterior exposed wall cabinet bottoms to be Pressure Fused White laminate both sides. Assembly devices to be concealed on bottom side of wall cabinets.

3. Cabinet Ends:

a. Holes drilled for adjustable shelves 1 1/4 inch on center.
b. Exposed exterior cabinet ends to be laminated with high pressure plastic laminate, balanced with high pressure cabinet liner interior surface.
c. Front edges shall be flush with door/drawer face.

4. Fixed and Adjustable Shelves:

a. Thickness: Behind doors, to be 3/4 inch to 27 inches wide. One inch shelving at 30 inch wide cabinet and over.
b. Thickness at all widths of open cabinets to be 1 inch.
c. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate 3/4" thick stretcher located behind the back panel and be secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 x 2" plated flat head screws.

5. Cabinet Backs:

a. Cabinet back to be fully housed into sides, top, and bottom, recessed 7/8 inch from cabinet rear. Rear, unexposed, side of back to receive continuous bead of hot melt adhesive at joint between back and sides/top/bottom.
b. Hang rails shall be glued to rear of cabinet back and mechanically fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.
c. Exposed exterior backs to be high pressure plastic laminate balanced with high pressure cabinet liner.

6. Door and Drawer Fronts:

    a. Laminated door and drawer fronts to be 13/16 inch thick for all hinged and sliding doors. Drawer fronts and hinged doors are to overlay the cabinet body. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
    b. Stile and Rail doors shall be 13/16 inch thick glazed with full ¼ inch glass. Available hinged or sliding. All exposed lite-opening edges shall be trimmed and glazed with extruded vinyl glazing bead.

7. Drawers:

    a. Drawer fronts shall be applied to separate drawer body component sub-front.
    b. Drawer sides shall be dadoed and glued to receive front and back, machine squared and held under pressure while hot melt glued and pinned together.
    c. Drawer bottom to be housed into front, sides and back. Underside of drawer to receive continuous bead of hot melt adhesive at joint between bottom and back/sides/front for sealing and rigidity. Reinforce drawer bottoms with 1/2 inch by 4 inch front-to-back intermediate underbelly stiffeners, hot melt glued and fastened. One at 24 inch, two at 36 inch, four at 48 inch.
    d. Paper storage drawers fitted with full width hood at back.
    e. All drawers shall have roller guides as specified under Paragraph 2.1.E.3.

8. Vertical and Horizontal Dividers: One of the following as indicated by cabinet number:

    a. Natural hardboard 1/4 inch thick, smooth both faces. Secured in cabinet with molded plastic clips.
    b. Pressure Fused laminate 3/4 inch thickness. Secured in cabinet with molded plastic clips or dowels.

9. Door/Drawer Front Rail: Provide minimum 3/4 inch x 6 inch x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, close off reveal, and be locator for lock strikes.

10. ADA-Americans with Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on architectural plans as "ADA", or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:

    a. Countertop height: with or without cabinet below, not to exceed a height of 34 inches A.F.F., (Above Finished Floor), at a surface depth of 24 inches.
    b. Kneecap clearance: to be minimum 27 inches A.F.F., and 30 inches clear span width.
    c. 12 inch deep shelving, adjustable or fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.
    d. Wardrobe cabinets: Shall be furnished with rod/shelf adjustable to 48 - 72 inches A.F.F. at a maximum 21 inch shelf depth.
    e. Sink cabinet clearances: in addition to 10.a,b. above, upper kneecap frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F., and as further described in Volume 56, Section 4.1.9.

B. Countertops:

1. General: High pressure plastic laminate bonded to particleboard core. Thickness as shown on plans. Underside to be properly balanced with heavy gauge backing sheet. Provide tops in as long as practical continuous lengths. Provide field glued spleens at joints. No joints closer than 24 inches either side of sink cutout.

   a. Edge Treatment: Self-Edge.

2. Science Lab and Prep Room Casework Tops, Sinks, and Troughs:

   a. Physical Properties: Comply with the following minimum requirements:

      1) Flexural strength: 15,000 psi.
      2) Compressive strength: 30,000 psi.
      3) Hardness (Rockwell M): 100.
      4) Water absorption (24 hours): 0.02 percent (maximum).
      5) Heat distortion point: 350 deg. F.
      6) Thermal-shock resistance: Highly resistant.

   b. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, test procedure 3.9.5:

      1) Acetone: Moderate effect.
      2) Acetic acid (98) percent): No effect.
      3) Hydrochloric acid (37 percent): No effect.
      4) Nitric acid (70) percent): No effect.
      5) Phosphoric acid (85) percent): No effect.
      6) Sulfuric acid (33 percent): No effect.
      7) Benzene: No effect.
      8) Butyl alcohol: No effect.
      9) Carbon tetrachloride: No. effect.
      10) Ethyl acetate: No. effect.
      11) Ethyl ether: No effect.
      12) Formaldehyde: No effect.
      13) Phenol (85) percent): No effect.
      14) Xylene: No effect.
      15) Ammonium hydroxide (28 percent): No effect.
      16) Sodium hydroxide (50 percent): Moderate effect.
      17) Zinc chloride: No effect.

   c. Sink Fabrication: Molded in one piece with surfaces smooth, corners coved, and bottom sloped to outlet: ½ inch minimum thickness.

      1) Provide sinks with ¼-inch thick lip around perimeter of sink for drop-in installation.
      2) Bond epoxy sinks installed in epoxy tops to tops and finish to produce an integral unit with invisible joint line.

   d. Locations: Epoxy resin tops and back splashes are to be located in All Science Labs and Prep Rooms.

3. Mobile Cabinet Tops: Shall be high pressure plastic laminate on exterior and high

pressure cabinet liner on underside. Edges shall be 3 mm PVC.

4. Butcher-Block Countertops:

   a. Fabricated from edgegrain narrow strips of lumber glued together and arranged for random mix of color and grain. Finish consisting of sealer with multiple lacquer coats per manufactures written instructions.

      i. Wood Species: Hard maple.
      ii. Strip Thickness: 1-1/4 inches
      iii. Location: Refer to drawings.

C. Workmanship

1. All exposed exterior cabinet surfaces to be .030 inch high pressure laminate. Laminate surface/balancing liner to core under controlled conditions, by approved and regulated laminating methods to assure a premium lamination. Natural-setting hybrid P.V.A. Type III water resistant adhesives that cure through chemical reaction, containing no health or environmentally hazardous ingredients, are required. Methods requiring heat are not allowed; "contract" methods of laminating are not allowed.
2. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components. End panels shall be doweled to receive bottom and top.
3. Back panel shall be fully housed into, and recessed 7/8 inch from the back of cabinet sides, top, and bottom to insure rigidity and fully closed cabinet. Cabinet back shall be shimmed from rear of body for tight interior fit.
4. Drawer bottom shall be fully housed into and recessed 1/2 inch up from the bottom of sides, back and subfront. Sides of drawer shall be fully dadoed to receive drawer back, locked in fully to subfront, fastened with glue and mechanical fasteners.
5. 3/4 inch thick hang rails shall be glued to backside and mechanically fastened to end panels of all wall, base, and tall cabinets for extra rigidity and to facilitate installation.
6. Rear of cabinet back and underside of drawer bottom joints to receive a continuous bead of hot melt adhesive to add to unit body strength and develop moisture and vermin seal.
7. All cases shall be square, plumb, and true.
8. Case body and drawer workmanship and quality of construction shall be further evidenced by Independent Testing Laboratory results as described in 1.4.D.
9. Provide removable back panels and closure panels for plumbing access where shown on drawings.

D. Mobile Cabinet Design and Construction:

1. No conventional particleboard-to-particleboard fastening allowed as structural members. Low mobile cabinets shall be designed with a structurally layered base, to which plate-type casters are bolted.
2. No exposed fasteners.
3. Design profile shall be flush inset door and flush inset finished back, between end panels.
4. Unit top shall be 3 mm PVC with radiused corners, and overhand case front, back, and sides to function as a bumper system.

E. Science Casework Mechanical Service Fixtures:

1. Service Fixtures: Provide units complete with washers, locknuts, unions, nipples and other accessories for positive mounting to supporting laboratory units. Include wall and deck flanges, escutcheons, handle extension rods, remote valves, and similar items required. Fabricate units to withstand test pressure of 100 psig.
2. Material and Finish: Fabricate service fixtures from cast or forged red brass containing a minimum of 85 percent copper. Exposed surfaces including fittings and escutcheons, polished chrome plated finish.
    a. Hot and Cold Water Mixing Outlet: Use for mixing of hot and cold water (HCW) as noted on drawings and as follows. Outlets shall be Swing spouts with aerators, deck mounted.
3. Service Outlets Identification: Provide colored plastic index discs with embossed identification letters at each service fixture handle or knob. Secure discs to fixture handles to be virtually tamperproof. Color-code discs as follows:

Service	Color	Code Letter	Color
Gas	Blue	Gas	White
Hot Water	Red	HW	White
Cold Water	Green	CW	White

4. Ground Key Type Hose Cocks: Tapered core and handle of one piece forged brass, ground and lapped, held in place under constant spring pressure.
5. Handles: Provide 3-arm or 4-arm forged brass handles for valves, stops, faucets, remote controls, and cocks, except for ground key cocks and micro-adjustable needle cocks.
6. Needle Valve: Provide units with renewable self-centering floating cones and renewable seats of stainless steel.
7. Water Valves or Faucets: Provide units with renewable barrel locked in valve body. Barrel shall contain all wearing parts, with renewable discs.
8. Remote Control Valves: Although straight through type are indicated, use angle valves wherever required.
9. Self-closing cocks: Wherever drawing symbols are followed by “DC”, provide self-closing valves.
10. Vacuum Breakers: Provide vacuum breakers on all water fixtures (hot or cold) equipped with serrated outlets.

F. Electrical Service Fixtures

1. Service Fixtures: Provide units complete with metal housing or box; necessary receptacles, terminals, switches, pilot lights, device plates; and fittings and gaskets required for mounting on casework. All fixtures UL labeled.
2. Cover Plates: Provide stainless steel cover plates for AC outlets and devices, and laminated plastic plates for DC or combination AC/DC outlets and devices.
    a. Stainless steel, Type 302, satin finish, with formed beveled edges.
3. Finishes for Service Fixture Components: Furnish housings or boxes for pedestal type and line type fixtures with manufacturer’s standard finish. For painted surfaces, use baked-on chemical resistant enamel in color as selected by Architect from manufacturer’s standard.

4. Provide galvanized finish on ferrous fittings.
5. Receptacles: Furnish AC receptacles for AC circuits, as follows. Unless otherwise indicated, provide stainless steel colored units.
    a. 20 amp, 125 volt, duplex, 30wire, grounding type.
6. Furnish DC receptacles and terminal and other special outlets as indicated on drawings.
7. Switches: Furnish single pole, double pole, or 3-way switches, as required, rated 120-277 volts AC, and in amperage capacities to suit units served. Furnish in color to match receptacles.
    a. Furnish pilot lights adjacent to toggle switch.
    b. Furnish thermal overload switches of single pole or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.
    c. Furnish DC switches, single pole or double pole, as required, rated 125-250 volts DC, and in amperage capacities to suit units served.

H. Goggle Cabinet: Kerkau

1. UV sterilization cabinet with safety door switches and key lock. Unit shall be constructed of 22-gauge steel with reflective interior surfaces for complete sterilization of microorganisms. Equipped with (2) long-life ultraviolet bulbs for 8,000 hours of use, 1-hour timer, amber-colored sight glass activation light and 8-foot, 18/3 grounded power cord, 110V. Epoxy Powder Coat Finish, Color: White. Capacity for (40) glasses/goggles.
    a. Refer to drawings for model numbers and locations.

PART 2 – EXECUTION

2.1 COORDINATION

A. Coordinate work of this Section with related work of other Sections as necessary to obtain proper installation of all items.

B. Verify site dimensions of cabinet locations in building prior to fabrication.

2.2 INSTALLATION

A. Storage and Protection: Casework shall be protected in transit. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

B. Workmen: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics certified by manufacturer.

C. Workmanship

1. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.

2. Install all items complete and adjust all moving parts to operate properly.
3. Leave surface clean and free from defects at time of final acceptance.

D. Guarantee: All materials shall be guaranteed for a period of 5 years from manufacturer's defects and workmanship.

E. Clean Up: Remove all cartons, debris, sawdust, scraps, etc., and leave spaces clean and all casework ready for Owner's use.

END OF SECTION 123216

SECTION 123661 - SIMULATED STONE FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.
2. Solid-surface-material sills.

B. Related Requirements:

1. Division 6 Section “Interior Architectural Woodwork” for custom cabinets.
2. Division 7 Section “Joint Sealants” for sealants installed with solid surface materials.
3. Division 22 Section "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.3 SUBMITTALS

A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment, provisions and coordination requirements with adjacent work.

B. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.

C. Maintenance data: Submit manufacturer’s care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

D. Samples: Contractor shall provide manufacturer’s color pdf images of solid-surface-material for review & approval. Actual samples are NOT required unless specifically requested by the architect/interior designer.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL FABRICATION

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top and bottom.
2. Backsplash: Straight, slightly eased at top and edges.

B. Countertops: 1/2-inch- with front edge built up with same material.

1. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

a. Fabricate with loose backsplashes for field assembly.
b. Make cutouts to templates furnished by the manufacturer.
c. Reinforce edges and cutouts as recommended by the manufacturer.

2. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

3. Cutouts and Holes:

a. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

1) Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
2) Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.

b. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

C. Backsplashes: 1/2-inch thick, solid surface material.

D. Window Sills: 1/2-inch thick, solid surface material, adhesively joined with inconspicuous seams with built-up edge with slight radius. Refer to drawings for details.

2.2 MATERIALS

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Adhesives: Do not use adhesives that contain urea formaldehyde.

C. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturers: Subject to compliance with requirements, provide the following

a. Dupont, Corian Solid Surface.

2. Colors: As selected from Group 4, up to (2) colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install solid-surface-materials level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface. Refer to drawings for additional details.

1. Seal edges of cutouts in plywood subtops by saturating with varnish.

C. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

D. Apply sealant to gaps at walls; comply with Division 7 Section "Joint Sealants."

E. Install all solid-surface-materials to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

END OF SECTION 123661

SECTION 124813 - ENTRANCE FLOOR MATS – ALTERNATE BID

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 of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Rubber-Tire Mats.

B. Related Requirements:

1. Division 3 Sections “Cast-in-Place Concrete” for Moisture Vapor Reduction Admixture.
2. Division 9 Section “Resilient Base and Accessories” for resilient wall and accessories installed with resilient tile.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of floor mat specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing layout and types of floor mat, full-scale sections of typical installations, details of patterns or designs, and accessories.

D. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual sections of floor mat materials, showing full range of colors, textures, finishes, and patterns available.

E. Samples for verification purposes in form of 12-inch-square assembled section of floor mat with selected tread surface showing color of exposed floor mat. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

F. Maintenance data in form of manufacturer's printed instructions for cleaning and maintaining floor mats.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain floor mats and frames from one source from a single manufacturer.

1.5 SEQUENCING AND SCHEDULING

A. Defer mat installations until building enclosure is completed and related interior finish work is in progress. Recess in-fill concrete where required for placement of concrete topping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of Design:

a. R.C. Musson Rubber Co.,

i. Series: TT-12CT

2. Approved Manufacturers:

a. American Floor Products Co.
b. Pawling Corp., Standard Products Div.
c. U.S. Mat and Rubber Co., Inc.

2.2 MATERIALS

A. General: Provide colors, patterns, and profiles of materials as selected by Architect from manufacturer's standard colors, patterns, and profiles.

1. Color: As selected from manufacturers full range of color selections. Provide a minimum of (4) colors.

B. Rubber-Tire Mats: Provide manufacturer's standard units of edge-grain-laminated and chenille-buffed rubber-tire wall cuts, bonded to sheet rubber or other durable flexible backing sheet in 12 inches by 12 inches by 3/8-inches thick for surface mount installation.

C. Adhesives: Provide manufacturer’s adhesive, Musson NO. TT-390 Non-Flammable Environmentally Safe Outdoor Adhesive.

1. Provide adhesive for the following substrates:

a. Substrates without moisture vapor reduction admixture: Porous Adhesive.
b. Substrates with moisture vapor reduction admixture: Non-Porous Adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install surface-type units to comply with manufacturer's instructions, at locations indicated and coordinated with entrance locations and traffic patterns.

3.2 PROTECTION

A. Upon completion of concrete work, provide temporary filler of plywood or fiberboard in recesses. Maintain protection until construction traffic has ended and project is near time of Substantial Completion.

B. Defer installation of floor mats until near time of Substantial Completion for project.

END OF SECTION 124813

SECTION 126623 – TELESCOPIC CHAIR PLATFORM SPECIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Telescoping Chair Platform Seating includes electrically operated systems of multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.
   1. Typical applications include the following:
      a. Wall Attached Telescoping Platform Seats.

B. Section Includes: Fixed Chair Platform Seating. Includes multiple-tiered seating rows comprising of seat, deck components, understructure that permits fixed beam understructure to provide egress pathways and or rooms to be added within the structure.
      a. Standalone beam fixed chair platform seating designed for use below designated seating zone

1.02 MANUFACTURER'S SYSTEM ENGINEERING DESCRIPTION

A. Structural Performance: Engineer, fabricate and install telescopic auditorium seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each auditorium seat unit.
   1. Design Loads: Comply with ICC 300

B. Manufacturer's System Design Criteria:
   1. Auditorium seat assembly: Design to support and resist, in addition to its own weight, the following forces:
      a. Live load of 120 lbs per linear foot on seats and decking
      b. Uniformly distributed live load of not less than 100 lbs per sq. ft. of gross horizontal projection.
      c. Parallel sway load of 24 lbs. per linear foot of row combined with (b.) above
      d. Perpendicular sway load of 10 lbs. per linear foot of row combined with (b.) above

   2. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:
      a. Concentrated load of 200 lbs. applied at any point and in any direction.
      b. Uniform load of 50 lbs. per foot applied in any direction.

3. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:
    a. Concentrated load of 200 lbs. applied at any point and in any direction along top rail.
    b. Uniform load of 50 lbs. per foot applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot applied vertically downward.

4. Member Sizes and Connections: Design criteria (current edition) of the following shall be the basis for calculation of member sizes and connections:
    a. AISC: Manual of Steel Construction
    b. AISI: Specification for Design of Cold Formed Steel Structural Members
    c. AA: Specification for Aluminum Structures
    d. NFOPA: National Design Guide For Wood Construction.

C. Chairs
1. Seats:
    a. Shall be cantilevered, self-centering, automatic three-quarters lift with over center retracting feature for ease of row passage and janitorial access.
    b. Seat shall be tested and professionally certified through an independent testing laboratory to support and withstand an evenly distributed 600 lb static load without failure or irregularities that would impair usefulness.
    c. Self-lifting seat shall be tested and professionally certified through an independent testing laboratory to withstand 350,000 operating cycles without failure of seat mechanism or measurable component wear.
    d. Seat shall be tested and professionally certified to withstand 10,000 impacts of a 40 lb sandbag dropped on the center of the seat from each of the following heights: 6", 8", 10", and 12". The rate of impacts shall be approximately 18 per minute with the total quantity of impacts equaling 40,000.

2. Backs:
    a. Back shall withstand an evenly distributed front or rear static load of 450 lbs.
    b. Back shall be tested and professionally certified to withstand, without failure, 40,000 swinging impacts each to the front and rear of the back by means of two opposing 40 lb. sandbags. The sandbags shall be moved horizontally and equally for 10,000 cycles each at the following distances of 6", 8", 10", and 12" at a rate of 35 cycles per minute.
    c. Back shall withstand, without failure, an evenly distributed Horizontal Traverse Static Load of 200 lbs. The load shall be applied to the top of the back at a 45-degree angle to the row of seats.

3. Materials (Flammability) shall satisfy applicable test, codes, standards, or requirements as follows:
    a. Copolymer polypropylene shall have a burn rate of 1 inch per minute or less per ASTM 635.
    b. Upholstery materials shall meet requirements as set forth in the state of California Bureau of Home Furnishings Technical Bulletin 117.
    c. Fire-performance Characteristics of Seat Padding: Provide seating that complies with test method: California Technical Bulletin 117.
    d. Cushioning and padding shall be self-extinguishing as defined in the requirements as set forth in the State of California Bureau of Home Furnishings Technical Bulletin 117.

1.03 ACTION SUBMITTIALS

A. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations

B. Provide Current Welding Certification[s] AWS or CSA.

C. Provide Installer Name, Current Certification Number and Product Qualifications

D. Provide Manufacturers' standard warranty documents.

E. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.
    1. Electrical: Indicate power supply requirements.
    2. Graphic Drawing Proofs & Layouts

F. Samples: Seat materials and color finish as selected by Architect from manufacturers standard offered color finishes.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver telescopic platforms in manufacturers packaging clearly labeled with manufacturer name and content.
B. Handle seating equipment in a manner to prevent damage.
C. Deliver the seating at a scheduled time for installation that will not interfere with other trades operating in the building.

1.05 PROJECT CONDITIONS

A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping Chair Platform installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.06 WARRANTY

A. Manufacturer's Warranty: Includes the repair or replacement of the defective product; or defective component thereof, with a comparable product; or component thereof, or a refund of the purchase price prorated over the warranty period.

1. Includes: Labor, materials, and freight for replacement or repairs.
2. Structural Component parts of Understructure Warranty Period: 10 years from Date of Acceptance
3. Decking systems, seating collections, electrical, end closure curtains, surface material finishes Warranty Period 5 years from Date of Acceptance.

1.07 MAINTENANCE AND OPERATION

A. Instructions: Both operation and maintenance shall be transmitted to the Owner by the manufacturer of the seating or his representative.
B. Service: Maintenance and operation of the seating system shall be the responsibility of the Owner or his duly authorized representative, and shall include the following:
   1. Operation of the Seating System shall be supervised by responsible personnel who will assure that the operation is in accordance with the manufacturer's instructions.
   2. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the seating.
   3. An annual inspection and required maintenance of each seating system shall be performed to assure safe conditions. At least biannually the inspection shall be performed by a professional engineer or factory qualified service personnel.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Hussey Seating Company, North Berwick, Maine. Tel. No. 207-676-2271
   1. Product: MAXAM+ Telescopic Platform System by Hussey Seating Company

      a. MAXAM+ Series Telescopic Platform Seats, adjustable row spacing: 33 inches.
      b. MAXAM+ Series Telescopic Platform Seats, row rise 11 5/8”
      c. Aisle Type: Front steps and intermediate aisle steps.
         (a) Seat Type: Metro chairs with padded back and upholstered seat
         (b) Metro Chairs color finish: manufacturers 19 standard colors.
      d. Rail Type: P Rail-Tier 1.

(1) Rail color finish: Standard black

e. Operation: Electric
f. Electrical Power System: Integral power with pendant control
g. Chair Operation: Fully automate, row 1 is manually lowered in groups of 13 chairs, then the remaining rows will fold down automatically. All rows of chairs must be raised manually from the stored position, in groups of up to 13.
h. Chair Construction: Upholstered seat and upholstered back.
i. ADA spaces to be located in front of first row with companion seating by others.
j. Enclosure, lighting, and outlets needed in the interior storage area will be done by others.

2.02 DIMENSIONAL AND OPERATIONAL CRITERIA

A. Dimensions:

1. Product Description/Criteria
   a. Bank Length: 37'-6
   b. Aisle Widths: See drawings
   c. Number of Tiers: 11 tiers/10 seating rows
   d. Row Spacing(s): 33"
   e. Open Dimension: See drawings.
   f. Closed Dimension: See drawings.
   g. Overall Unit Height: See drawings
   h. Maximum Net Capacity: 192

B. Other Acceptable Manufacturers: Will be considered if in compliance with these specifications. A line-by-line deviation list of this specification must be submitted with the manufacturer's substitution request in order that a fair and proper evaluation be made.

2.03 MATERIALS

A. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine

B. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.

C. Structural-Steel Shapes, Plates, and Bars: ASTM A36.

D. Galvanized-Steel Sheet: ASTM A653, Grade 40 coating designation G60.
E. Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.

F. Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33, Grade 36, Grade 40, Grade 45, or Grade 50, Structural Quality, Hot-Rolled.

G. Galvanized Steel Strip: ASTM A653 Grade 40, or Grade 64, structural quality, coating designation G60.

H. Tubing: ASTM A500, cold formed; Grade B, or ASTM A513, 46ksi min yield

I. Polyethylene Polymer: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

J. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.04 UNDERSTRUCTURE FABRICATION

A. Frame System:

1. Wheels: Not less than 5" diameter by 1 1/4" with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8" diameter axles secured with E-type snap rings.
2. Lower Track: Continuous Positive Interglide System interlocks each adjacent CPI unit using an integral, continuous, anti-drift feature and through-bolted guide at front to prevent separation and misalignment. CPI units at end sections of powered banks and manual sections shall contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
3. Slant Columns: High tensile steel, tubular shape.
4. Sway Bracing: High tensile steel members through-bolted to columns.
5. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment. Incorporates multiple stops to allow field adjustment of row spacings.
6. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

B. Deck System:

1. Section Lengths: Each bank shall contain sections not to exceed 19’-5” in length with a minimum of two supporting frames per row, each section.
2. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40. Riser beam shall be continuously roll-formed of ASTM A653 Grade 64. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
3. Deck End Overhang: Not to exceed frame support by more than 5'-11".

4. Decking Option
   a. Poly Deck: Shall be a high-density polyethylene overlay panel fabricated with a skid-resistant textured top surface of 100% moisture barrier bonded to a plywood substrate with an exterior glue. Panel thickness shall be 3/4” with top polyethylene surface colored weathered gray, black or beige.

2.05 SEAT FABRICATION

A. Metro Telescopic Platform Chair System

1. Chair System: Beam-mounted design, consisting of chairs independently mounted. Top of support arms shall be designed to capture and secure the beam in place. Support arms articulate from manual assist or semi-automatic operating mechanism.

2. Seat Support:
   a. Each of the independent seat hinges shall be fitted with up and down stops as well as double acting; self-centering, preloaded coiled seat return springs with silencers.
   b. Chairs must be designed with two independent return springs which position seat pan in 3/4 fold position with 100 percent fold position available for added aisle passage. Seat action shall be dampened for a constant velocity return and no final oscillations to the rest position.
   c. Hinges, seat support, return springs, and stops shall be enveloped and concealed by the seat and back shells. Seat shall have the ability to achieve a full fold position when rearward pressure is applied. Superior comfort shall be derived through careful ergonomic engineering.

3. Upholstered Seats / Backs: seats and backs
   a. Each seat and back shall be textured one-piece gas-assist injection molded pigmented polypropylene shells.
   b. Upholstery shall be a complete self-retaining unit, welded to the seat and back surfaces using a hot plate welding technique.
   c. Each unitized upholstery panel shall be comprised of medium density virgin urethane foam on a precision injection molded polypropylene backer. The fabric cover shall be tensioned over and neatly enclose both foam and backer.
   d. Each seat and back shall be internal structured with peripheral gas channel frame. The frames shall support, resist, and transmit design loads to the aluminum chair beam.
   e. Seat foam cushion shall be not less than 1 1/2” thick; back foam cushion shall not be less than 1” thick.
   f. Seat “covers” shall be of a three-piece construction, without welts, taut, and securely retained.
   g. Tailoring shall evidence a superior level of design, workmanship and fit.
   h. Seat (bottom) closure shall be textured plastic with front and sides turned 180 degrees to regain and protect cover. Pan materials, texture, and color shall match chair back; non-matching seat pan/back construction materials and finishes are not acceptable.
   i. Standard Bottom Cover: Seat shell/bottom shall be constructed of polypropylene plastic to provide a durable yet aesthetic design. The cover shall protect the mechanical parts of the lifting hinge and upholstered cover. The shell / bottom shall compliment the overall design of the chair.

4. Chair Beam: Shall be constructed of extruded aluminum with polymer end caps and serve as the focal attachment and shall in turn transmit all forces to the beam support.

5. Beam support: Shall be cast steel support arms. Closed seam steel tube standards are unacceptable. Top of support arms shall be designed to capture and secure the beam in place. Support arms articulate from manual assist or semi-automatic operating mechanism.

2.06 SHOP FINISHES

A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with black "Dura-Coat" enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish.

B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
   1. Steel nosing and rear risers shall be pre-galvanized with a minimum spangle of G-60 zinc plating.
   2. Decking shall have use-surfaces to have 0.030" laminated polyethylene wear surface.

C. Railings: Steel railings shall be finished with powder-coated semi - gloss black or optional 15 standard colors to match polymer seat color.

D. Chair Components
   1. FINISH FOR Steel / Aluminum Components: (Indoor) Material shall be pre-treated in an iron phosphate wash system prior to finish application. Finish shall be a specially blended polyester T.G.I.C./Epoxy powder coating with a minimum dry film thickness of 1.5 mils.
   2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors and have a textured surface.
   3. Fabric: Upholstery material shall be one of manufacturers standard grade fabric offerings.
   4. Color: Shall be per manufacturer's standards. Seating Contractor shall submit color samples for owner's approval prior to manufacture.

2.07 FASTENINGS

E. Welds: Performed by welders certified by AWS standards for the process employed.

F. Structural Connections: Secured by structural bolts with prevailing torque lock nuts, free-spinning nuts in combination with lock washers, or Riv-nuts in combination with lock washers.

2.08 ELECTRICAL OPERATION SYSTEMS

A. Integral Power

   1. Default operation shall be with a removable pendant control unit which plugs into seating bank for tethered operator management of stop, start, forward, and reverse control of the power operation. Other modes of operation are optional.

B. PF3: Furnish and install Hussey an integral automatic electro mechanical powered frame propulsion system, to open and close telescopic seating.

1. Electrical - Seating Manufacturer shall provide all wiring within seating bank, including pendant control. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code. The control system shall operate at low voltage (24V). The electrical contractor shall perform all connections at and upstream of the equipment specified herein and ensure that supplied voltage drops no more than 4% below nominal where power connects thereto.
2. Annual Service Light
    a.) The annual service light unit is a low voltage (24V) system that is integrated into the electrical control system on a powered chair platform.
        1.) This system shall be UL Listed under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating.
    b.) This unit serves two main functions:
        1.) Keep a continuous timer running that will indicate to the end user that an annual inspection of the chair platform is required.
            a.) The unit will retain the counting data for no less than 6 months without power.
            b.) There will be a light illuminated at the front of the chair platform once the counter reaches one calendar year.
            c.) The counter and light can be reset by authorized personnel once an inspection has been completed.
        2.) Record the forward, reverse, and total operating time of chair platform.
            a.) This data can be viewed at any time from inside of the unit.
    c.) Manufacturer shall furnish parts and instructions for installing an annual service light unit on the primary seating bank.

2.09 ACCESSORIES

A. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Steel front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated.
B. Intermediate Aisle Steps: Steel intermediate aisle steps shall be of boxed fully enclosed type construction. Blow molded end caps shall have full radius on all four edges. Step shall have adhesive-backed abrasive non-slip tread surface. Quantity and location as indicated.
C. Intermediate Store-In-Place Aisle Handrails: Provide single pedestal mount handrails 34” high with terminating mid rail. Handrails shall be lifted, rotated 90° and reinserted for easy storage in socket. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable.
D. Poly Deck: Decking panel to be a 0.030” thick high-density polyethylene overlay panel fabricated with a skid-resistant textured top surface permanently bonded to a Western Fir plywood substrate meeting the requirements of NBS PS-1-97. Panel thickness shall be 5/8” with tongue and grooved edge joints and top polyethylene surface of textured gray, black or beige color.

E. Safety Accessories: Provide the following safety features:
   1. Coin Round or Roll all edges of exposed metal on top and underneath chair platform to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the chair platform understructure components as follows. Diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.
   2. Provide polymer end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
   3. Provide polymer end cap on back of deck supports on 1st 7 Rows to prevent spectator injury.
   4. On 1st Row, provide front and side skirt boards anywhere there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
   5. Provide metal cover over motor chains and wheels to protect chains from debris and provide a safety switch that if cover is taken off the power system will not work.
   6. Provide metal end deck cover on each row to cover exposed edge of plywood at the ends of the chair platforms.
   7. Powered frames systems without a metal protective housing, covering drive chain and drive wheels are not permitted under this specification.

F. Access hatchway to allow access to underside of wall-to-wall chair platform at row 4.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify area to receive telescoping auditorium seats are free of impediments interfering with installation and condition of installation substrates are acceptable to receive telescoping auditorium seats in accordance with telescoping auditorium seats manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

3.02 INSTALLATION

A. Manufacturer's Recommendations: Comply with telescoping auditorium seats manufacturer's recommendations for product installation requirements.

B. General: Manufacturer’s Certified Installers to install telescoping auditorium seats in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of telescoping auditorium seats and for permanent attachment to adjoining construction.

3.03 ADJUSTMENT AND CLEANING

A. Adjustment: After installation completion, test and adjust each telescoping auditorium seats assembly to operate in compliance with manufacturer's operations manual.

B. Cleaning: Clean installed telescoping auditorium seats on both exposed and semi-exposed surfaces. Touch-up finishes restoring damage or soiled surfaces.

3.04 PROTECTION

A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure telescoping auditorium seats are without damage or deterioration at time of substantial completion.

END OF SECTION 126623

SECTION 142400 - MACHINE-ROOM-LESS HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes machine-room-less, holeless hydraulic passenger elevators.

B. Related Requirements:

1. Division 3 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Division 4 Section “Unit Masonry Assemblies" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Division 5 Section "Metal Fabrications" for attachment plates and angle brackets for supporting guide-rail brackets, hoist beams, pit ladders and sump pit covers.
4. Division 8 Section “Door Hardware” for various keying requirements.
5. Division 22 Plumbing Sections relating to sump pumps in elevator pits.
6. Division 26 through 28 Electrical Sections for electrical service, communications, detectors and alarm systems.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
2. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.

3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands. Include loads required for sizing of hoist beam, which is provided by others.

C. Samples for Initial Selection: For each type of exposed finish involving color selection. Upon request, provide physical Samples of colors and finishes preliminarily selected as needed for final selection, including, but not limited to, plastic laminate, stainless steel, enameled or powder-coated steel, and translucent ceiling panels.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Submit manufacturer's or Installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

D. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in same form as, a "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of inserts, sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, inserts, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of work specified in other Sections that relates to hydraulic elevators including pit ladders; hoist beams; sumps and floor drains in pits; entrance subsills; electrical service; telecommunications service; and electrical outlets, lights, and switches in hoistways and pits.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

B. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide ThyssenKrupp enduraMRL Elevator or comparable products by one of the following:

1. Schindler Elevator Corp.
2. Otis Elevator Co.
3. Canton Elevator, Inc.
4. KONE Inc.
5. Alliance Elevator Solutions.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard machine room-less elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system. Units specified herein are based on products offered by the basis-of-design manufacturer. Refer to Paragraph 2.12 in this Section regarding deviations.

B. Elevators – General:

1. Operation System: Selective-collective automatic operation.
2. Power Requirements: 208V, 3 Phase, 60 Hz.
3. Auxiliary Operations:

    a. Battery-powered lowering.
    b. Automatic operation of lights and ventilation fans.

4. Security Features: Keyswitch operation.
5. Car Enclosures:

    a. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
    b. Car Fixtures: Satin stainless steel, No. 4 finish.
    c. Door Sills: Aluminum, mill finish.
    d. Handrails: 1-1/2 inches round, satin stainless steel, No. 4 finish, at sides and rear of car.
    e. Floor recessed and prepared to receive finish as scheduled.

6. Hoistway Entrance Doors: Satin stainless steel, No. 4 finish.
7. Additional Requirements: Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.

C. Elevator: Elevator shall be equal to ThyssenKrupp Elevator “enduraMRL 2500” twin-post, above-ground, three-stage system. Requirements specific to this unit are as follows:

1. Rated Load: 2,500 lbs.
2. Rated Speed: 110 fpm.
3. Stops and Travel: Two levels, one stop per floor; 16’-10” total travel distance.
4. Car Enclosures:

    a. Inside Width: Not less than 6’-8” inches clear from side wall to side wall; overall platform width shall be approximately 94 inches.
    b. Inside Depth: Not less than 4’-3” inches clear from back wall to front wall (return panels); overall platform depth shall be approximately 5’-1” inches.
    c. Inside Height: Not less than 7’-4” inches to underside of ceiling.
    d. Side and Rear Wall Panels: Plastic Laminate

e. Door Faces (Interior): Stainless Steel with No. 4 brushed finish.
f. Ceiling: Metal ceiling with LED downlights.

5. Hoistway Entrances:

a. Width: 3’-6” clear opening.
b. Height: 7’-0” clear opening.
c. Type: Single-speed, side-sliding, left hand side opening.
d. Frames (all floors): Stainless steel.

6. Hall Fixtures (all floors): Satin stainless steel, No. 4 finish.

a. Hall Lanterns: NA.

7. Special Conditions: Elevator entrances are to be connected to owner’s card access control system. Operation of the elevator is to be limited to only those who possess an electronic access card when read by the card reader, is granted access via owner programmed access system.

2.4 SYSTEMS AND COMPONENTS

A. Pumps and Controls: Self-contained oil pumping and control mechanism located in the elevator pit.

1. NEMA 4, sealed oil reservoir with tank cover, including vapor removing tank breather.
2. Manufacturer’s standard oil hydraulic pump.
3. Electric motor.
4. Electronic oil control valve, consisting of the following components that are built into single housing:

a. High-pressure relief valve.
b. Check valve.
c. Automatic unloading up-start valve.
d. Lowering and leveling valve.
e. Electromagnetic controlling solenoids.

B. Pump: Positive displacement-type pump specifically manufactured for oil hydraulic elevator service. Pump output shall not vary more than 10 percent variation between minimum and maximum elevator car loads. Pump shall be designed for steady discharge with minimum pulsation.

1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts.
2. Motor: Manufacturer’s standard motor designed for oil hydraulic elevator service. Motors shall be capable of 80 starts per hour, with a 30-percent motor run time during each start. Motor shall have variable-voltage, variable-frequency control.
3. Solid State Starting: Provide an electronic starter that features adjustable starting currents.

a. Provide 110VAC, single-phase secondary power source as needed for repositioning the elevator in the event of a system component failure, including pump motor or starter malfunction.

4. Hydraulic Silencers: Provide manufacturer's standard oil hydraulic muffler devices at the power unit location, which shall consist of pulsation-absorbing materials inserted in a blowout-proof housing.

C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

1. Cylinder units shall be connected with dielectric couplings.

D. Oil Control Unit: Unit shall be readily accessible so that adjustments or repairs may be made without disassembling from oil line. Include the following components within a single housing:

1. Adjustable relief valve, capable of bypassing the total oil flow without back-pressure increase of more than 10 percent beyond the valve in off position.
2. Adjustable up-start and stop valve, capable of bypassing oil flow during start and stop of motor pump assembly. Valve shall close slowly and gradually divert oil to or from jack unit, ensuring smooth up-starts or up-stops.
3. Check valves, designed to close quietly and without permitting detectable reverse flow.
4. Adjustable lowering and leveling valves for down-start speed, lowering speed, leveling speed and stopping speed, to ensure smooth down-starts and –stops. Leveling valve shall be designed to allow car to be leveled with the floor in the same direction as the car is traveling after slowdown is initiated.
5. Provide constant speed regulation in both up and down directions. Feature shall compensate for load changes and oil temperature or viscosity changes.

E. Hydraulic Fluid: USDA-certified, readily-biodegradable and ultra-low toxicity with minimum 95 percent bio-based content per ASTM D 6866; energy-efficient, high-performance fluid made from canola oil with antioxidant, anticorrosive, antifoaming and metal-passivating additives.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated. The main car control in each car shall contain the devices required for specific operation, mounted in an integral swing return panel.

1. Electrical Component Access: Provide lockable "Security Group 2" panel at controller landing entrance jamb above first landing for access to the critical electrical components indicated below, sized in accordance with NEC, as well as for troubleshooting.

a. Disconnect: Three-phase, fused disconnect switch with auxiliary contact and shunt trip capability.

1) For alternative, non-basis-of-design manufacturers who do not furnish disconnect devices, refer to Paragraph 2.12 in this Section.

b. 110V, single-phase circuit breaker for cab light and fan.

2. Car Top Inspection: Provide an inspection station at the top of the car with an "auto-inspection" switch, an "emergency stop" switch, and constant-pressure "up-down" directional and safety pushbuttons to override the normal operating device functions, providing complete control of the elevator to the inspector. The station shall be mounted in the door operator assembly.

B. Controller: Microprocessor-based, software-oriented controller; unit shall be integrated into hoistway entrance jamb above first landing and protected from environment and vibrations in a locking NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of pushbuttons in the car, numbered to correspond with each floor served, for registering car stops, and by depressing up and down pushbuttons at each intermediate landing and "call" pushbuttons at terminal landings.

1. For alternative, non-basis-of-design manufacturers whose controllers are not accessible via hoistway entrance jambs, refer to Paragraph 2.12 in this Section.

C. Service Panel: Located outside the hoistway in the controller entrance jamb, consisting of the following functions:

1. Access to main control board and CPU.
2. Main controller diagnostics.
3. Main controller fuses.
4. Universal Interface Tool (UIT).
5. Remote valve adjustment.
6. Electronic motor starter adjustments and diagnostics.
7. Operation of motorized shutoff valve in pit, with LED feedback of the valve.
8. Operation of auxiliary pump/motor (secondary hydraulic power source).
9. Operation of electrical-assisted manual lowering.
10. Provide male plug to supply 110 VAC into the controller.
11. Run-Stop button.

D. Auxiliary Operations:

1. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor below, opens its doors, and shuts down. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source. System shall include rechargeable battery and automatic recharging system.
2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
3. Nuisance-Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
4. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open. The settings shall be field-programmable.

E. Security Features: Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Pushbuttons shall be activated and deactivated by security keyswitches at hall push-button stations. Key to match building keying system shall be removable in either position. Elevator manufacturer shall provide small format cylinder housing to accept permanent key core by hardware supplier, per North Hardware Set No. 353 and South Hardware Set No. 418, as indicated in Division 8 Section "Door Hardware."

2.6 HOISTWAY EQUIPMENT

A. Platform: Manufacturer's standard wood subfloor supported by a fabricated frame of formed or structural steel shapes, gusseted and rigidly welded or bolted; underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25 percent of the rated capacity.

B. Sling: Steel stiles anchored to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guides: Steel, omega- or similar-shaped profile, anchored to the building structure with manufacturer's standard steel brackets.

1. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
2. Guide Shoes: Slide guides shall be mounted on top and bottom of car.
3. Buffers: Manufacturer's standard shock-absorbing buffers mounted to steel plates and anchored to elevator pit floor slab. Provide extension if required per Project conditions.

D. Jack: Twin-post, holeless, telescoping, multi-stage units, of sufficient size and weight to accommodate loading of elevator at heights required. Factory-tested to ensure adequate strength and anti-leaking capabilities. Provide multiple sections of pipe telescoped together and designed to extend in a synchronized manner upon oil being pumped into assembly; each jack section shall be guided from within the casing or the plunger assemblies used to house the sections.

1. Provide built-in check valve into assemblies for automatic resynchronization of plunger sections by moving the jack to its fully-contracted position.
2. Provide a bleeder valve in each assembly to discharge any trapped air.
3. Mount assemblies to each side of hoistway and anchor to car and to pit floor or recess cast into pit floor.

E. Self-Leveler: Manufacturer's standard feature designed to automatically bring the car to the landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing regardless of its load.

F. Hoistway Accessories:

1. Wiring: Provide all necessary hoistway wiring in accordance with all applicable codes, including the current National Electrical Code as adopted by the authority having jurisdiction.
2. Piping: Provide all required code-compliant piping and associated fittings for connections between the power units and jack assemblies.
3. Pit Sensor: Locate manufacturer's standard elevator pit moisture/water sensor approximately 1 foot above the pit floor surface. Upon activation, the elevator shall switch to "flooded pit operation" mode, which shall automatically move the car to the designated floor level, cycle the doors and shut down and trip the circuit breaker shunt to disrupt 3-phase power from all equipment, including pit equipment.

4. Shut-Off Valve: Provide motorized oil line shut-off unit, which shall have the ability to be remotely operated from the controller or manually operated from the valve location in the pit.
5. Hoist Beams: Steel framing shall be provided by entities other than the elevator manufacturer or installer as required to support elevator hoisting from the building structure. Coordinate with requirements in Division 5 Section "Metal Fabrications" for materials and fabrication.

2.7 CAR ENCLOSURES

A. General: Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation. Fabricate car with recesses and cutouts for signal equipment.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Floors: Provide exterior, underlayment-grade plywood subfloor, not less than 5/8-inch nominal thickness. Subfloor shall be adequately prepared and set at elevations required for scheduled floor finish (provided by other trades), as indicated on the Drawings.
2. Wall Finishes: Provide the following:
   a. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch, urea-formaldehyde-free, fire-retardant-treated wood core with manufacturer's standard protective edge trim. Panels shall have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
   b. Reveals shall be stainless steel.
3. Doors:
   a. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
   b. Fabricate car door frame integrally with front wall of car.
   c. Sight Guards: Provide sight guards on car doors, which shall match door edges.
4. Ceilings: Provide the following:
   a. Metal Ceiling: Flush panels of finish indicated, with LED downlights in the center of each panel. Where applicable, align ceiling panel joints with joints between wall panels.
5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
6. Canopy: Cold-rolled steel with hinged exit.
7. Light Fixture Efficiency: Not less than 35 lumens/W.
8. Ventilation Fan Efficiency: Not less than 3.0 cfm/W; mount fan on top of car.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sight guards, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: Not less than 1 hour, with 30-minute temperature rise of 450 deg F; provide 1-1/2-hour ratings where hoistway entrances are located within 2-hour-rated shaft or wall construction.

C. Door Hanger and Tracks: Provide sheave-type, two-point suspension hangers and tracks for each hoistway sliding door assembly.

1. Sheaves: Tires constructed of polyurethane or similar material, with ball bearings properly sealed to retain grease.
2. Hangers: Constructed with adjustable device to prevent up-thrust of doors during operation.
3. Tracks: Drawn steel shapes with smooth surface; design shall accommodate hanger sheaves.

D. Interlocks: Equip each hoistway entrance with manufacturer’s standard safety interlock device, tested for conformance to applicable code, including door restriction devices.

E. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Frames: Provide the following:

a. Stainless-Steel Frames: Formed from stainless-steel sheet.

2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
3. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.9 DOOR OPERATION

A. Door Operation: Provide a direct current, motor-driven, heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Closed-loop, microprocessor- controlled, motor-driven, linear door operator, with adjustable torque limits, shall also be acceptable. Provide the following operation capabilities:

1. No Unnecessary Door Operation: The car door shall open only if the car is stopping for a car- or hall-initiated call, responding to a car- or hall-initiated call at the present position, or selected as a dispatch car.
2. Door Open Timesaver: If a car is stopping in response to a car call assignment only (without a coincident hall call), the current door hold-open time shall be changed to a shorter field-programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, without car calls or other hall call assignments, the car door shall open to respond to the hall call in the direction of the car's current travel. If an onward car call is not registered prior to the door closing to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to respond to the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or other obstruction within the door opening. If a door's closing process is prevented for a field-programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infrared door protection system detects a person or obstruction while closing on nudging, the door shall stop and resume closing only after the obstruction has been removed.
5. Limited Door Reversal: If the doors are closing and the infrared beam is interrupted, the doors shall reverse and partially reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field-adjustable time, the doors shall recycle closed and then attempt to open six times in an attempt to correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field-adjustable time, the doors shall recycle open and then attempt to close six times in an attempt to correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Devices: Provide a door reopening device with uniform array of 36 or more microprocessor-controlled infrared light beams projecting across car entrance. The beams shall project across the car opening to detect the presence of a passenger or object. Interruption of one or more light beams shall cause doors to stop and reopen.

2.10 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Keyswitch Operation: Provide keyswitches to access control station compartments. Key shall match building keying system. Elevator manufacturer shall provide small format cylinder housing to accept permanent key core by hardware supplier, per North Hardware

Set No. 353 and South Hardware Set No. 418, as indicated in Division 8 Section “Door Hardware.”

3. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Mark buttons and switches for function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

D. Emergency Communication System: Only where required by the authority having jurisdiction, provide two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

1. Firefighters' Two-Way Telephone Communication Service: Flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section "Fire Alarm."

E. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.

1. Provide manufacturer's standard units with flat faceplate fabricated from satin stainless steel with No. 4 finish for mounting with body of unit recessed in wall. Provide buttons with blue-illuminating LED halos to indicate that a call has been registered at that floor.

a. Pushbutton stations may be built into face of hoistway door jamb in lieu of being recessed in wall.

2. Where applicable, equip units with buttons for calling elevator and for indicating desired direction of travel.
3. Only where required by the authority having jurisdiction, provide the following firefighter service items:

a. Phase 1 firefighter’s service keyswitch, with instructions, incorporated into hall stations at level to be determined by the authority having jurisdiction.
b. Telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28 Section "Fire Alarm."

G. Hall Lanterns: Units with illuminated arrows; provide “up” and “down” arrows at intermediate landings and single arrows at terminal landings. Provide units mounted at manufacturer’s standard locations for optimal viewing.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Signage: Fabricate and install emergency signs, of pictorial and/or alphanumeric design, as indicated or as required by authorities having jurisdiction. Fabricate from materials matching hall push-button stations, unless otherwise indicated.

1. Provide manufacturer’s standard text and graphic emergency signs indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station.
2. Provide manufacturer’s standard text and graphic “No Smoking” signs on each car operating panel.
3. Floor Identification: Provide one door jamb-mounted metal panel at each entrance, identifying the floor in which it is located (single number or letter); design shall be manufacturer’s standard, in contrasting color and complying with all applicable accessibility requirements.

2.11 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A 1011, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A 240, Type 304.

D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

E. Aluminum Extrusions: ASTM B 221, Alloy 6063.

F. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

2.12 MANUFACTURER DEVIATIONS

A. Manufacturers other than the basis-of-design manufacturer may possess standards that generally meet the requirements of this Section and of the basis-of-design manufacturer, but may be considered as deviations. It is understood that in order to provide a fully-operational, complete elevator system, additional components or slight revisions to the scope of work may be required. However, the Owner shall not be responsible for additional costs associated with such deviations; additional construction costs, and design-related costs (if necessary), due to any revisions shall be the sole responsibility of the General Contractor; in turn, at their own discretion, the General Contractor may hold the elevator manufacturer and/or installer/subcontractor responsible for these costs. The bids should generally reflect these anticipated cost impacts. Such deviations include, but are not limited to, the following:

1. Controller Units: The basis-of-design manufacturer’s standard location for their controller units is integrated into the hoistway entrance jamb on the next-to-lowest floor level. Alternative manufacturers whose standard location for the controller unit is not part of a hoistway entrance jamb or similar location shall be responsible for the costs associated with providing an alternative means of accessing the controller unit, including

full-size swinging door assemblies that are to be installed in the elevator hoistway and steel lintels supporting masonry openings. In this scenario, the General Contractor shall be responsible for the cost of these openings, which, for consistency purposes, shall be furnished and installed by the same entities that are furnishing and installing the swinging door assemblies throughout the rest of the Project. Final door locations and orientation shall be coordinated prior to procurement and construction. In general, the following assemblies shall be provided for each hoistway:

a. Door Frames: Type "H1" hollow metal door frame (per the Hollow Metal Frame Elevations on Drawing A6.12 of South Building), factory-primed and field-painted, with fire rating of 45 minutes (for one-hour fire-rated shaft assemblies) or 90 minutes (for two-hour fire-rated shaft assemblies). Frame throat thickness shall match wall thickness. Refer to Contract Drawings and Division 8 Section "Hollow Metal Doors and Frames" for additional information.
b. Doors: Type "F" wood door (per the Door Types on Drawing A6.11 of South Building) with factory-applied finish; size shall be 3'-0" wide x 7'-2" high, unless greater dimensions are required for access, with fire rating of 45 minutes (for one-hour fire-rated shaft assemblies) or 90 minutes (for two-hour fire-rated shaft assemblies). Refer to Contract Drawings and Division 8 Section "Flush Wood Doors" for additional information.
c. Hardware: Provide Hardware Set No. 302 (South Building) for each opening, as indicated in Division 8 Section "Door Hardware."

2. Electrical Disconnect Devices: The basis-of-design manufacturer's standard is to furnish the fused disconnect switch as part of the elevator package, in which final connections shall be made by the Electrical Contractor. If the alternative manufacturer's standard is to not furnish electrical disconnect devices as part of their standard elevator package, they must either furnish these components or otherwise the General Contractor shall be responsible for the cost for other entities to furnish them.
3. Electrical Service: Aside from the main line disconnects, any revisions required for electrical service as needed to operate the elevators that result in cost changes shall be the responsibility of the General Contractor.
4. Mechanical Requirements: Any costs associated with additional equipment required for cooling or ventilating the elevator hoistway and/or pit other than what is indicated in the Contract Documents shall be the responsibility of the General Contractor.
5. Hoistways and Pits: This Section and the Contract Drawings have been developed based on the basis-of-design manufacturer's standards, including elevator hoistway and pit requirements. If the alternative manufacturer's equivalent elevator designs require greater hoistway dimensions or pit depths, or other dimensional or layout revisions that would result in additional costs, these costs shall be the responsibility of the General Contractor.
6. Pit Ladders: Manufacturers whose standard is to provide their own pit ladders, in lieu of other trades, may do so; however, prior to submitting their proposal, the elevator manufacturer/installer/subcontractor shall verify this with the General Contractor to ensure that only one entity will provide pit ladders.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, and pits as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. Place hall lanterns either above or beside each hoistway entrance.
2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use, perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Operating Test: Load each elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record

temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142400

SECTION 144213 WHEELCHAIR PLATFORM STAIR LIFT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Indoor inclined platform wheelchair lifts.

1.2 REFERENCES

A. ASME A17.5 - Elevator and Escalator Electrical Equipment.

B. ASME A18.1a 2001 - Safety Standard for Platform Lifts and Stairway Chairlifts.

C. CSA B44.1 - Elevator and Escalator Electrical Equipment.

D. CSA B355 - Lifts for Persons with Physical Disabilities.

E. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

F. NFPA 70 - National Electric Code.

G. CSA - National Electric Code.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Submit manufacturer's installation instructions, including preparation, storage and handling requirements.
   2. Include complete description of performance and operating characteristics.

C. Shop Drawings:
   1. Show typical details of assembly, erection and anchorage.
   2. Show complete layout and location of equipment, including required clearances.

D. Selection Samples: For each finished product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finished product specified, two samples, representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years documented experience in manufacturing of inclined wheelchair platform lifts of installations of type specified.

B. Installer Qualifications: Firm licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of

replacement parts and have qualified people available to ensure timely maintenance and callback service at the project site.

1.5 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:
   1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
   2. ASME A17.5 - Elevator and Escalator Electrical Equipment.
   3. NFPA 70 - National Electric Code.

B. Provide platform lifts in compliance with:
   1. CSA B355 - Lifts for Persons with Physical Disabilities.
   2. CSA B44.1/ASME A17.5 - Elevator and Escalator Electrical Equipment.
   3. CSA - National Electric Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.7 PROJECT CONDITIONS

A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.8 WARRANTY

A. Warranty: Manufacturer shall warrant the wheelchair lift materials and factory workmanship for seven (7) years (2 year standard and optional additional 5 year extended) following Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance for elevator system and components for the following periods from Date of Substantial Completion.
   1. Two years standard warranty period.
   2. Five years extended warranty period.

B. Include systematic examination, adjustment, and lubrication of elevator equipment. Repair or replace parts whenever required. Use parts produced by manufacturer of original equipment. Replace wire ropes when necessary to maintain required factor of safety.

C. Provide emergency call back service for this maintenance period.

D. Perform maintenance work using competent and qualified personnel approved by elevator manufacturer or original installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :

1. Garaventa Lift; United States - P.O. Box 1769, Blaine, WA 98231-1769. Canada 18920 – 36th Ave., Surrey, BC V3Z 0P6. ASD. Toll Free: 800-663-6556. Tel: (604) 594-0422. Fax: (604) 594-9915. Email: productinfo@garaventalift.com; Web www.garaventalift.com.
2. Savaria Omega Inclined Platform Lift 2 Walker Drive Brampton, Ontario L6T 5E1 – 1-800-savaria
3. Harmar Sierra Incline Platform Lift | IL500 – 2057 47th St. Sarasota, FL 34234 – 1-941-308-7300

2.2 STAIR LIFT FOR STRAIGHT AND TURNING STAIRWAYS

A. Inclined Platform Lift: (Basis of Design) Garaventa Stair-Lift, Model GSL Artira inclined platform lift for straight and turning stairways. Lift consists of a tubular guide rail system, a folding platform that is moved along the guide rails by a rope sprocket drive system, overspeed safety system and call stations at each landing. Conform to the following design requirements:

1. Application:
   a. Indoor.
2. Platform Load Rating: 660 lbs (330 kg).
3. Travel Speed: 20 fpm (101.6 mm/s), slowing to 50 percent of rated speed before entering and while rounding corners.
4. Platform Deck: 16 gauge (1.6 mm) sheet metal coated with electrostatically applied and baked anti-skid Sandex black paint.
   a. Platform Size A (ADA Compliant): 31-1/2 inches (800 mm) wide by 48 inches (1220 mm) long.
5. Platform Operation:
   a. Automatic Fold: Folded and unfolded electrically from the call station.
   b. Emergency Manual Fold: When unit is left in the open position, platform may be manually folded and retained in closed position.
6. Under Platform Obstruction Sensing:
   a. Provide an under platform sensing device to stop the platform from traveling in the downward direction when encountering 4 lbs (1.8 kg) of pressure.
   b. Platform is permitted to travel in the opposite direction of obstruction to allow clearing.
7. Passenger Restraining Arms:
   a. Platform equipped with retractable passenger restraining arms in compliance with ASME A18.1a.
   b. Arms stop moving when an obstruction causing 4 lbs (1.8 kg) of pressure is encountered and will immediately retract when the signal is removed.
   c. Provide with means to manually unlock and open the restraining arms for passenger emergency evacuation.
   d. Top of arms mounted 37-3/8 inches (948 mm) above the platform deck. When in guarding position the arms are located above the perimeter of the platform.
   e. The gaps between ends of arms shall not exceed 4 inches (100 mm).

8. Boarding Ramps:
    a. Provide boarding sides of platform with retractable ramps positioned for travel at a height of 6 inches (152 mm) measured vertically above the platform deck.
    b. Lock ramps in their guarding positions during travel. When the platform is at the landing, only the retractable ramp servicing the landing shall be operable.
    c. Ramps shall be folded and unfolded electrically.
    d. Retractable ramps, in the guarded position, shall withstand a force of 125 lbs (556 N) applied on any 4 inch (100 mm) by 4 inch (100 mm) area. This force shall not cause the height of the ramp, at any point in its length, to be less than 6 inches (152 mm) measured vertically above the platform deck.
    e. Provide a means to manually unlock the ramps for emergency evacuation when platform is located at a landing.
    f. Provide a bi-directional obstruction sensitive device on the travel direction end of the platform to stop lift when 1.8 kg (4 lbs.) of pressure is encountered, either from inside or outside of the platform. Platform is permitted to travel in the opposite direction of obstruction to allow clearing.
    g. When platform folds, passenger restraining arms shall fold down and be covered by the folded platform.
9. Platform Kick Plate:
    a. Provide non-boarding and non-guide-rail side of the platform with a kick plate barrier of not less than 6 inches (152 mm) in height, measured vertically from the platform deck.
    b. When the platform is folded the kick plate shall cover the platform controls providing protection from vandalism.

10. Pedestrian Safety Lights:
    a. Equip platform with amber pedestrian safety lights located at both ends of the platform to alert pedestrian traffic that the platform is on the stairway.
11. Hand Grips:
    a. Equip platform with two 6-7/8 inch (174 mm) long by 1-1/4 inch (32 mm) diameter aluminum hand grips or grab bars on the front face of the platform with the top being 33-1/4 inch (845 mm) above the platform deck.
12. Clearance Dimensions:
    a. When folded platform shall not protrude more than 12-5/8 inches (321 mm) to 13-5/8 inches (346 mm) from mounting surface.
    b. When unfolded and in use platform shall not protrude more than 40 inches (1015 mm) to 41 inches (1040 mm) from wall.
13. Controls:
    a. Platform Controls: 24 V Low Voltage type.
    b. Platform equipped with emergency stop switch located within reach of the passenger 37-1/8 inches (942mm) above platform deck. When activated emergency stop button shall cause electric power to be removed from the drive system stopping lift immediately.
    c. Operating controls shall be two separate 1-1/2 inches (36 mm) round constant pressure buttons with directional arrows mounted on the front surface of the platform control panel.

d. Directional buttons shall prompt the user with the available travel direction by illuminating the appropriate button.
e. When platform arrives at landing and the user releases the directional button, the passenger restraining arms and boarding ramp shall unfold automatically allowing passenger to disembark.
f. Platform shall equipped for:
1) Keyless operation.

14. Passenger Seat: Fold-down type with safety belt.
15. Side Loading Platform: Provide with an automatic folding ramp on the side of the platform opposite the guide rails for loading where lower landing clearance is limited.
16. Platform Deck Light: Integral lamp automatically activated when platform is in unfolded position.
17. Platform Security Lock: Provide to prevent unauthorized unfolding of the platform.
18. Attendant Hand Held Pendant Control: Provide with plug-in socket on platform control panel.
19. Autofold Platform: Automatically fold platform into storage position when left unused in open position at any landing for:
a) 3 minutes
20. Pedestrian Audio Alert: Provide chime mounted on platform to indicate platform is folded up and in motion, traveling on stairway.
21. Platform On Board Emergency Alarm: Provide platform with on board alarm that sounds when emergency stop button is pushed. Provide battery back up for platform on board alarm.
22. Remote Platform Boarding: Platform shall travel beyond standard boarding position to remote boarding location away from stairs. Provide with ramp extensions 3 inch (76 mm) extruded aluminum added to the boarding ramps.
23. Under Hanger Sensing: Provide bottom of platform hanger with a sensing plate to stop the platform from traveling in the downward direction when encountered with 4 lbs (1.8Kg) of pressure. It shall be possible to drive the platform away from the obstruction.
24. Side of Hanger Obstruction Device: Provide a sensor that detects obstructions in the path of the side of the hanger. Lift shall stop immediately and not travel until the obstruction is removed. It shall be possible to drive the platform away from the obstruction.

B. Drive and Guide Rail System
1. Operation:
a. Motor: 2 H.P. electric motor with an integrated brake.
b. Required power: 208-240 VAC, single phase, 50/60 Hz. on a dedicated 20 amp circuit. Rated current shall be 7 amps for operation with rated load.
c. Locate roped sprocket drive system consisting of a motor, gearbox and PCC controller (Programmable Configuration Controller) at the upper end of the tubes. PCC controller shall be custom programmed to soft start and stop and the slow down platform travel speed for all corners and landings of the lift. Normal operating speed shall be 20 feet per minute (6 m per minute), slowing to 50 percent of this speed before entering and while rounding corners.

d. Equip drive with an emergency manual lowering system.

2. Standard Drive Cabinet:
   a. Cabinet: 20-1/2 inches (520 mm) wide by 41-1/2 inches (1053 mm) high by 10-5/8 inches (270 mm) deep.
   b. Cabinet door is key locked and monitored with an electrical cutout safety switch.
   c. Provide an integrated lockable main disconnect switch and breaker on the drive cabinet.
3. Compact Drive Cabinet with Separate Control Box:
   a. Compact drive cabinet will house all mechanical drive system components and shall be located at the end of the tube system.
   b. Controller box will contain all the electrical components of the drive system and be located up to 20 feet (6 M) away from the compact drive. Control box dimensions are 12 inches (305 mm) wide by 24 inches (610 mm) high by 11-1/4 inches (284 mm) deep.
   c. Provide an integrated lockable mains disconnect and breaker in the compact drive control box.
4. Guide Rail:
   a. Construct of two 2 inch (51 mm) diameter steel tubes spaced 23-5/8 inches (600mm) apart vertically. Tubes will run parallel to the stairs and horizontal to landings throughout the length of travel.
   b. When negotiating a horizontal landing a third 2 inch (51 mm) diameter steel tube shall be added to the tube system to guide and stabilize platform.
   c. Tube system shall not protrude more than 4-7/8 inches (125 mm) to 5-7/8 inches (150 mm) from the wall.
   d. Suspension means contained in the tubes shall be a 3/8 inch (8 mm) diameter galvanized steel core wire rope with a breaking strength of 9460 pounds (4300 kg).
   e. Locate overspeed safety at the bottom of the tube assembly and shall consist of a mechanical overspeed sensor and brake with electrical drive cut-out protection.
   f. Provide a final limit switch at the upper end of the tubes to stop the platform if it travels past the normal terminal stopping device.
5. Auxiliary Power: Provide battery back-up system for normal up / down lift operation during power failure for a minimum period of 1/2 hour with rated load.
6. Platform Storage Beyond Upper/Lower Landings:
   a. Platform shall travel in the folded position beyond the upper landing at the top stair nose to a remote parking position away from the stairs.
   b. Platform shall travel in the folded position beyond the lower landing to a remote parking position. Provide with a ramp extension for this configuration.
7. Final Limit Switch at Lower Landing: Platform will land over a flight of stairs and will have a final lower limit switch.
8. Rail Mounting:
   a. Tower Mount Struts: Provide with 2-1/2 inches (65 mm) by 2-1/2 inches (65 mm) hollow structural steel tubular posts to support the guide rails.

C. Pedestrian Handrail Integrated with Guide Rail:

1. A third rail acting as a handrail shall be added where existing handrails are either removed or blocked by the lifting equipment.
2. The top of the handrail gripping surface shall be between 34 inches (864 mm) and 38 inches (965 mm) above the stair nosing and have a smooth gripping surface 1-1/2 inch (38 mm) in diameter.
3. Handrail shall be in the same vertical plane as the guide rail system.
4. Handrails shall be mounted to the tube assembly and shall not be interrupted by newel posts, or other construction elements or obstructions.

D. Call Stations:
1. Provide a call station at each serviced landing that will automatically shut off if left unattended for over 2 minutes.
2. Call stations, 24 V low voltage with four illuminated 2 inches (51 mm) by 2 inches (51mm) square membrane touch sensitive buttons: one touch platform fold, one touch platform unfold and two directional call and send buttons.
3. Provide call stations with Smart-Lite Technology to prompt the user with the next sequential step of operation. Call station buttons will emit an audible "beep" when pushed to confirm button activation to the user.
4. Call stations shall equipped for:
    a. Keyless operation.
5. Provide Attendant Call buttons on each call station.
6. Call Station Mounting:
    a. Lower and Intermediate landing call station.
        1) Provide surface mounted call station.
    b. Upper landing call station.
        1) Provide surface mounted call station on guide rail.
    c. Provide free-standing mounting pedestals for call stations located as follows:
        1) Lower landing.
        2) Intermediate Landing.
        3) Upper landing.

E. Additional Safety or Code Requirements
1. Wall Mounted Audio Visual Alerts: Provide with adjustable volume control that sound while the lift is in operation and are visible by pedestrian traffic from all flights and landings.
2. Building Fire Alarm Integration: Coordinate with Section 13650 Building Fire Alarm System to connect the lift control system with the building fire alarm system. If the lift is not in operation when the building fire alarm system is activated power will be cut to the lift preventing use during fire evacuation. If the lift is in use when the building fire alarm system is activated, the lift shall only allow the passenger to travel to the designated landing with the emergency exit.

F. Finish Environment Requirements:
1. Design and fabricate lift to manufacturer's standard design for indoor location.
2. Stainless Steel Components: Design and fabricate lift using the following:
    a. Guide rails shall be supplied in stainless steel.
    b. Handrails shall be supplied in stainless steel.
    c. Support towers shall be supplied in stainless steel.

d. Drive box shall be supplied in stainless steel.
e. Wall mounted audio visuals shall be supplied in stainless steel.
f. Platform sensing plate shall be supplied in stainless steel.
g. Fasteners for rail assembly and anchoring shall be supplied in stainless steel.

3. Design and fabricate lift to manufacturer's standard design for outdoor location.
   a. Lift to include all modifications recommended by manufacturer for reliable performance in outdoor climate of lift installation site.
   b. Platform control cover shall be fabricated of a Silver Grey injection-molded polymer.
   c. Platform Cover: Provide a durable and weather resistant nylon platform cover for protection.
4. Painting: After pretreating paint with electrostatically applied and baked powder coat as follows:
   a. Fine Textured Satin Grey (RAL 7030).
   b. Custom color as selected by Architect from manufacturers standard RAL colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify required supports are correct.

C. Verify electrical rough-in is at correct locations.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install platform lifts in accordance with in compliance with regulatory requirements specified and the manufacturer's instructions.

B. Install system components and connect to building utilities.

C. Accommodate equipment in space indicated.

D. Startup equipment in accordance with manufacturer's instructions.

E. Adjust for smooth operation.

3.4 FIELD QUALITY CONTROL

A. Perform tests in compliance with regulatory requirements specified and as required by authorities having jurisdiction.

B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 144234

SECTION 200100 - GENERAL PROVISIONS - MECHANICAL

1. GENERAL

A. The Advertisement for Bids, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Each Proposer shall also be governed by any unit prices and Addenda insofar as they may affect his part of the work or services.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s) indicated or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.

E. It is not the intent of this section of the specifications to make any Contractor, other than the General Contractor (or Construction Manager, if applicable), responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect (if applicable), then to the Engineer. Also, this section of the specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

F. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

G. In general, and to the extent possible, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owners at least two weeks prior to the interruption of any services or utilities. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this

requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

H. Definitions and Abbreviations

(1) Contractor - Any Contractor whether proposing or working independently or under the supervision of a General Contractor and/or Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Sprinkler, Gas Systems, etc.) or, the General Contractor.

(2) Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc. In this case: CMTA, Inc., Consulting Engineers.

(3) Architect - The Architect of Record for the project.

(4) Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

(5) Provide - Furnish and install complete, tested and ready for operation.

(6) Install - Receive and place in satisfactory operation.

(7) Indicated - Listed in the Specifications, shown on the Drawings or Addenda thereto.

(8) Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

(9) Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owners, etc.

(10) Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.

(11) OSHA - Office of Safety and Health Administration.

(12) KBC - Kentucky Building Code.

(13) The Project - All of the work required under this Contract.

(14) NEC - National Electrical Code.

(15) NFPA - National Fire Protection Association.

(16) ASME - American Society of Mechanical Engineers.

(17) AGA - American Gas Association.

(18) SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

(19) ANSI - American National Standards Institute.

(20) ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

(21) NEMA - National Electrical Manufacturers Association.

(22) UL - Underwriters Laboratories.

(23) ADA - Americans with Disabilities Act.

(24) IMC - International Mechanical Code.

(25) IECC - International Energy Conservation Code.

(26) IFGC - International Fuel Gas Code.

I. Required Notices:

(1) Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

2. INTENT

A. It is the intention of the Contract Documents to call for finished work, tested and ready for operation.

B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

3. DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete

the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. The drawings and specifications are intended to supplement each other. No Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Proposer shall request a clarification not less than twelve days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

C. The drawings and specifications shall be considered to be cooperative and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

F. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

G. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to ensure no conflict with other work.

H. Each Proposer shall review all drawings including Architectural, Mechanical, Electrical, Fire Protection, Landscaping, Structural, Surveys, etc., to ensure that the work he intends to provide does not encroach a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Proposer's responsibility to satisfactorily eliminate any such encroachment conflict or effect prior to the submission of his proposal. Each Proposer shall in particular ensure that there is adequate space to install his equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to ensure adequate spaces.

I. Where on the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

K. Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

L. Special Note: Always check ceiling heights indicated on Architectural Drawings and Schedules and ensure that they may be maintained after all mechanical and electrical equipment is installed. Do not install equipment in the affected area until the conflict is resolved.

4. EXAMINATION OF SITE AND CONDITIONS

A. Each Proposer shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. Each Proposer shall also fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. His proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, electrical services, etc., from that indicated. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall remunerate them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.

B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of Paragraph (A) immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of twelve days prior to bids.

C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineers.

D. Each Proposer shall furnish along with his proposal a list of specified equipment and materials which he is to provide. Where several makes are mentioned in the specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineers will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings is satisfactorily comparable to the items specified and/or indicated.

6. SUPERVISION OF WORK

A. The Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

7. CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, water and/or sewer system development charge, etc. in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. He shall hire an independent Registered

Engineer to witness installations and provide necessary certifications where required by utility companies, municipal agencies or others that have review authority. He shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to his part of the work prior to submission of a proposal.

B. The Contractor shall include in his work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

D. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable. Where required by the Code and/or the Authority Having Jurisdiction, provide the services of a field labeling agency to provide a UL label for the entire system in the field under evaluation.

E. All plumbing work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such plans are in the hands of the Contractor.

F. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Kentucky Building Code (KBC) and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association. Contractor shall secure a permit from the Division of HVAC. Final inspection certificate shall be provided by Contractor and a copy included in Operation and Maintenance Manuals.

G. Where minimum code requirements are exceeded in the Design, the Design shall govern.

H. The Contractor shall ensure that his work is accomplished in accord with the OSHA Standards and that he conducts his work and the work of his personnel in accord with same.

I. Work in elevators, elevator shafts and elevator equipment rooms shall comply with the Elevator Code enforced by the Commonwealth of Kentucky.

J. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings and Construction, Commonwealth of Kentucky and the American Disabilities Act.

K. All work in conjunction with a natural gas installation shall, in addition to all other Codes, Rules, Regulations, Standards, etc., comply with the requirements of the local gas supplier and/or standards and recommendations of the American Gas Association.

L. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings, and Construction, Commonwealth of Kentucky and the American Disabilities Act.

8. EQUIPMENT AND PIPING SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the structure or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc., as indicated or required by the Structural Engineer. This, in some instances, will require the Contractor to add an angle to a joist to transfer the load to a panel point. If in doubt, contact the Structural Engineer.

9. DUCT AND PIPE MOUNTING HEIGHTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

10. COST BREAKDOWNS (SCHEDULE OF VALUES)

A. Within thirty days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

11. CORRECTION PERIOD

A. All equipment, apparatus, materials, and workmanship shall be the best of its respective kind. The Contractor shall replace all parts at his own expense, which are proven defective as described in the General Conditions. The effective date of completion of the work shall be the date of the Architect's or Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of his operator or other employees. Refer to other sections for any special or extra warranty requirements.

B. It is further clarified that all required and specified warranties shall begin on the date of Substantial Completion, not at the time of equipment start-up.

C. All gas fired heat exchangers shall have 20 year warranty.

D. All compressors shall have five year warranty.

12. COMPUTER-BASED SYSTEM SOFTWARE

    A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

13. CHANGES IN MECHANICAL WORK

    REFER TO GENERAL AND SPECIAL CONDITIONS.

14. CLAIMS FOR EXTRA COST

    REFER TO GENERAL AND SPECIAL CONDITIONS.

15. SURVEY, MEASUREMENTS AND GRADE

    A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

    B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

    C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the contract documents, he shall promptly notify the Engineer and shall not proceed with this work until he has received instructions from the Engineer on the disposition of the work.

16. TEMPORARY USE OF EQUIPMENT

    A. The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineers. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

    B. Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

    C. A pre-start-up conference shall be held with the Architect, Owner, General Contractor and the Mechanical Contractor. Equipment shall not be started until after this meeting.

D. During all phases of construction:

(1) Outside Air Units:

a. These units shall not be used for temporary heating and cooling by the Contractor. They shall, however, be made operational, tested, etc. as specified during construction by the Contractor. Three complete sets of filters are required for each unit. In each unit, install one set of filters during construction. In each unit, install one set of filters at substantial completion. For each unit, leave third set of filters in boxes in appropriate mechanical room as a spare set for the Owner. Dispose of all construction filters.

b. At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.

17. TEMPORARY SERVICES

A. The Contractor shall arrange any temporary water, electrical and other services which he may require to accomplish his work. Refer also to General and Special Conditions.

18. RECORD DRAWINGS

A. The Contractor shall ensure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically in AutoCAD 2000 format along with the hand marked field set to the Engineer. Electronic bid drawings will be furnished to the Contractor for his use.

19. MATERIALS AND WORKMANSHIP

A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Proposer shall determine that the materials and/or equipment he proposes to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Ensure, through coordination, that no other Contractor seals off access to space required for equipment, materials, etc.

B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

C. Use extreme care in the selection of equipment and its installation to ensure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.

D. Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

E. All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity.

20. COOPERATION AND COORDINATION WITH OTHER TRADES

A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4" = 1'-0", clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

21. QUALIFICATIONS OF WORKMEN

A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workman shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of Architect, Contractor, etc.

B. All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined and clarified under Kentucky State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.

C. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades, except where only small amounts of such work are required and are within the competency of workmen directly employed by the Contractor involved.

D. All automatic control systems shall be installed by workmen normally engaged or employed in this type work, except in the case of minor control requirements (residential type furnaces, packaged HVAC equipment with integral controls, etc.) in which case, if a competent workman is the employee of this Contractor, he may be utilized subject to review of his qualifications by the Engineer and after written approval from same.

E. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

22. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

23. PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from physical, sun, and weather damage during the construction period. Such protection shall be by a means acceptable to the manufacturer and Engineer. All rough-in soil, waste, vent and storm piping, ductwork, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at his own expense.

24. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

25. BROKEN LINES AND PROTECTION AGAINST FREEZING

A. No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Special Note: Insulation on piping does not necessarily ensure that freezing will not occur.

26. CLEANING

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish and debris caused by his operations; and at the completion of the work, shall remove all rubbish, debris, all of his tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease,

dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

27. CONCRETE WORK

A. The Contractor shall be finally responsible for the provisions of all concrete work required for the installation of any of his systems or equipment. He may, at his option, arrange with the others to provide the work. This option, however, will not relieve the Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Mechanical work shall be 3000 psi minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication AC1-318. Heavy equipment shall not be set on pads for at least seven (7) days after pour. Insert 6-inch steel dowel rods into floors to anchor pads.

B. All mechanical equipment (tanks, heaters, chillers, boilers, pumps, air handling units, etc.) shall be set on a minimum of 4" tall concrete pads. Pads shall be taller where required for condensate traps. All concrete pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc. as required. Pads larger than 18" in width shall be reinforced with ½" round bars on 6" centers both ways. Bars shall be approximately 3" above the bottom of the pad. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms, all surfaces shall be rubbed to a smooth surface. Chamfer all square edges one-half inch.

C. In general, concrete pads for equipment shall extend four (4) inches beyond the equipment's base dimensions. Where necessary, extend pads 30 inches beyond base or overall dimensions to allow walking and servicing space.

D. Exterior concrete pads shall be four (4) inches minimum above grade and four (4) inches below grade on a tamped four (4) inch dense grade rock base unless otherwise indicated or specified. Surfaces of all foundations and bases shall have a smooth finish with one-half (1/2) inch chamfer on exposed edges.

E. All exterior below grade concrete structures (utility vaults, grease traps, manholes, etc.) shall be provided with exterior waterproofing. Waterproofing shall be hot-fluid applied rubberized-asphalt waterproofing membrane with elastomeric sheets at edges, corners, and terminations of membrane for continuous watertight construction. Apply in layers and reinforce as required to provide uniform seamless membrane minimum 4mm thickness. Also, seal penetrations into and out of the structure watertight. Provide Link-Seal modular seal or equal.

28. NOISE, VIBRATION OR OSCILLATION

A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at his expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineers.

29. ACCESSIBILITY

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.

C. The Contractor shall provide access panels for each concealed valve, control damper or other device requiring service as shown on engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

30. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, SURFACES, ETC.

A. The Contractor shall at his expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Architect and/or Engineer.

31. MAINTENANCE OF EXISTING UTILITIES AND LINES

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily.

B. Utilities and lines, where known, are indicated on the drawings. Locations and sizes are approximate. Prior to any excavation being performed, the Contractor shall ascertain that no utilities or lines are endangered by new excavation. Exercise extreme caution in all excavation work.

C. If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation or blasting in the respective area.

D. Cutting into existing utilities and services where required shall be done in coordination with and only at times designated by the Owner of the utility.

E. The Contractor shall repair to the satisfaction of the Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted with ten feet of electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only.

G. Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

32. SMOKE AND FIRE PROOFING

A. The Contractor shall fire and smoke stop all openings made in fire or smoke rated walls, chases, ceilings and floors in accord with the KBC. Patch all openings around ductwork and piping with appropriate type material to stop smoke at smoke walls and provide commensurate fire rating at fire walls, floors, ceilings, roofs, etc. Back boxes in rated walls shall be a minimum distance apart as allowed by code to maintain the rating. If closer provide rated box or fireproofing in code approved manner.

33. MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C50, conforming to this and all applicable standards for insulation resistance and dielectric strength.

B. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box, and N.E.C. required disconnecting means as specified or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

C. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting

KVA per horsepower. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 26 of Specifications for further requirements related to installation of motors.

34. CUTTING AND PATCHING

A. The Contractor shall provide his own cutting and patching necessary to install his work. Patching shall match adjacent surfaces and shall be to the satisfaction of the Architect and Engineer.

B. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.

C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

35. CURBS, PLATES, ESCUTCHEONS & AIR TIGHT PENETRATIONS

A. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.

B. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

C. Seal all duct, pipe, conduit, etc., penetrations through walls and floors air tight. If wall or floor assembly is rated then use similarly rated sealing method.

36. WEATHERPROOFING

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

37. OPERATING INSTRUCTIONS, MAINTENANCE MANUALS AND PARTS LISTS

A. Upon completion of all work tests, the Contractor shall instruct the Owner or his representative(s) fully in the operations, adjustment and maintenance of all equipment furnished. The time and a list of representatives required to be present will be as directed by the Engineer. Turn over all special wrenches, keys, etc., to the owner at this time.

B. The Contractor shall furnish three (3) complete bound sets for delivery to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and

equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs alone will not be acceptable for operating and maintenance instructions.

C. The Contractor, in the instructions, shall include a preventive maintenance schedule for the principal items of equipment furnished under this contract and a detailed, parts list and the name and address of the nearest source of supply.

D. The Contractor shall frame under Lexan in the main mechanical room all temperature control diagrams and all piping diagrams.

38. PAINTING

A. In general, all finish painting shall be accomplished under the Painting Section of the specifications by the Contractor; however, unless otherwise specified under other sections of these specifications, the following items shall be painted:

(1) All exposed piping, valve bodies and fittings (bare and insulated), including hangers, platforms, etc.

(2) All mechanical equipment not factory finished. Aluminum and stainless steel equipment, motors, identification plates, tags, etc. shall not be painted. All rust and foreign matter shall be thoroughly removed from surfaces prior to painting. All baked enamel factory finish of equipment which may have been scratched or chipped shall be touched up with the proper paint as recommended and supplied by the manufacturer.

(3) All ductwork exposed in finished areas (bare and insulated), all grilles, diffusers, etc. not factory finished. Paint the inside surfaces of all interior duct surfaces visible from any register, grille or diffuser opening on all jobs; surfaces shall receive one (1) prime coat of Rustoleum 1225 red "galvinoleum" or other approved equivalent primer and rust inhibitor and one (1) coat of Rustoleum 1579 jet black "Speedy Dry" enamel or approved equivalent applied in accordance with the manufacturer's recommendations.

(4) All insulated piping, ductwork and equipment shall be properly prepared for painting by the Contractor where mechanical items are to be painted. In the case of externally insulated duct and pipe, the Contractor shall provide 6 oz. canvas jacket with fire retardant lagging. The jacket shall be allowed to dry properly before applying paint to avoid shrinking after painting and exposing unpainted surfaces. The Contractor, at his option, may provide double wall ductwork in lieu of externally insulated ductwork with canvas jacket and lagging.

39. ELECTRICAL CONNECTIONS

A. The Contractor shall furnish and install all (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring thru starters, and shall furnish and install all required starters not factory mounted on equipment.

B. The Contractor shall, regardless of voltage, furnish and install all temperature control wiring and all associated interlock wiring, all equipment control wiring and conduit for the equipment that the Contractor furnishes. He may, at his option, employ at his own expense, the Electrical Contractor to accomplish this work.

C. After all circuits are energized and completed, the Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of the Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

D. The Contractor shall furnish motor starters of the type and size required by the manufacturer for all equipment provided by him, where such starters are necessary. Starters shall have overloads for each phase.

40. FINAL CONNECTIONS TO EQUIPMENT

A. The Contractor shall finally connect to mechanical services, any terminal equipment, appliances, etc., provided under this and other divisions of the work. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineers prior to installation.

41. REQUIRED CLEARANCE FOR ELECTRICAL EQUIPMENT

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

42. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

43. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction.

Furthermore, the Contractor shall ensure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

44. ABOVE-CEILING AND FINAL PUNCH LISTS

A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

(1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
(2) For review of all other work as the project nears substantial completion.

B. When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

Phone: (859) 253-0892 Fax: (859) 231-8357

The following is CMTA's guide for Division 20-25 required information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

DIVISION 20-25 – MECHANICAL **Field Representative:** _____
Project Engineer: _____

Description of Work	Scheduled Value	Labor	Material
Shop Drawings			
Mobilization/Permits			
Demolition			
Mechanical Shop Drawings			
Gas Piping Exterior			
Gas Piping Interior			
HVAC Sheet Metal			
VRF Systems			
Outside Air Units			
Grilles & Diffusers			
Insulation			
Controls			
Air Balance			
Factory Start-Up Reports			
Owner Training			
Record Drawings			
O & M Manuals			

Punchlist/Closeout			
Controls Check-out			

END OF SECTION 200100

SECTION 200200 - SCOPE OF THE MECHANICAL WORK

1. GENERAL

A. The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following:

(1) All mechanical exhaust systems.

(2) All insulation associated with mechanical systems.

(3) Condensate drainage systems.

(4) Complete heating, ventilation and air conditioning systems.

(5) Complete balancing of air systems.

(6) Complete natural gas piping systems.

(7) All applicable services and work specified in Section 200100; General Provisions - Mechanical.

(8) All specified or required control work.

(9) Provide all required motor starters, etc. not provided under the electrical sections.

(10) One year guarantee of all mechanical equipment, materials and workmanship.

(11) Thorough instruction of the owner's maintenance personnel in the operation and maintenance of all mechanical equipment.

(12) Thorough coordination of the installation of all piping, equipment and any other material with other trades to ensure that no conflict in installation.

(13) Approved supervision of the mechanical work.

(14) Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.

(15) Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and shall include such requirements in his base bid.

(16) Procurement of all required permits and inspections, including fees for all permits and inspection services and submission of final certificates of inspection to the Engineers (Plumbing, Boiler, HVAC, etc.).

(17) All necessary coordination with gas utility company, etc., to ensure that work, connections, etc., that they are to provide is accomplished.

(18) Factory start-up of all major equipment (including terminal HVAC equipment) and submission of associated factory start-up reports to the Engineer.

END OF SECTION 200200

SECTION 200300 - SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS & TOOLS

1. GENERAL

A. The Contractor's attention is directed also to the General and Special Conditions and Section 200100 - General Provisions - Mechanical as well as to all other Contract Documents as they may apply to his work.

B. The Contractor shall prepare and submit to the Engineer, through the General Contractor and the Architect (where applicable) within thirty (30) days after the date of the Contract, a minimum of seven (7) copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter.

C. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

D. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect (if applicable) to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

E. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

F. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project. Any items that differ from the Drawings or Specifications shall be flagged by the Contractor so the Engineer will be sure to see the item. Do not rely on the Engineer to “catch” items that do not comply with the Drawings or Specifications. The Contractor is responsible for meeting the Drawings and Specification requirements, regardless of whether or not something does not get caught by the Contractor or Engineer during shop drawing reviews.

G. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.

H. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

I. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

J. Shop Drawing Submittals

(1) All submittals for HVAC equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

(2) All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule.

(3) All items submitted shall be designated with the same identifying tag as specified on each sheet.

(4) Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

2. SHOP DRAWINGS

Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

Duct Insulation
HVAC Equipment
Exhaust Fans/System
Pipe Insulation
Electric Unit Heaters
Outside Air Units
Controls
GRD's
Fans

SPECIAL NOTES:

(1) Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (1) above. These documents shall include at least:

(a) Detailed operating instructions
(b) Detailed maintenance instructions including preventive maintenance schedules.
(c) Addresses and phone numbers indicating where parts may be purchased.

(2) Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system.

3. SPECIAL WRENCHES, TOOLS, ETC.

(1) The Contractor shall furnish, along with equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed under the Contract. Wrenches shall include necessary keys, handles and operators for valves, cocks, hydrants, etc. A reasonable number of each shall be furnished.

4. BALANCE REPORTS

A. Upon substantial completion of the project, the Contractor shall submit to the Engineers four (4) bound copies of the Certified Air and Hydronic Balance Report.

END OF SECTION 200300

SECTION 200400 - DEMOLITION AND SALVAGE

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

2. DEMOLITION

A. INTENT

It is the intent of this section to completely remove all components of any existing mechanical system no longer in use that will be open to view in, or will interfere with the operations of the completed building, or which will, in any way, interfere with project construction. Components of the existing mechanical systems which do not meet the above criteria, may be abandoned in place in a safe, workmanlike, code approved manner.

B. HVAC

(1) Remove from the project area all piping not to be reused and hangers, specialties, etc. that are accessible or that become accessible during construction and/or interfere in any way with any part of the construction or would be exposed in the completed building.

(2) Remove all temperature controls and related items that are accessible or become accessible during construction.

(3) Remove all existing heating and ventilating equipment not indicated to be reused from the building.

(4) The Contractor shall be responsible for the removal and/or relocation of any HVAC piping, equipment, fittings, valves, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Structural, Mechanical or Electrical Systems at no increase in the contract price.

(5) Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where HVAC equipment is removed.

(6) Unless otherwise noted, when removing equipment sitting on a concrete pad, also remove the concrete pad and patch and repair floor to match adjacent surfaces.

C. REFRIGERANT RECOVERY

(1) The Contractor shall have a licensed refrigerant recovery technician evacuate all refrigerants from all refrigeration equipment being removed in accordance with EPA guidelines and

regulations. The Contractor shall take all necessary precautions to not accidentally vent refrigerants to the atmosphere. The recovered refrigerant shall be offered to the Owner. If the Owner refuses it then it becomes the property of the Contractor.

D. THERMOSTAT, THERMOMETER, AND MERCURY BEARING DEVICE DISPOSAL

(1) The Contractor shall dispose of all mercury bearing materials in accordance with state and federal guidelines. The Contractor shall take all necessary precautions to not accidentally allow mercury to be released from the device during demolition.

3. SALVAGE

A. It is the intent of this section to deliver to the owner all components of any mechanical system which may be economically reused by him. The Contractor shall make every effort to remove reusable components without damage and deliver them to a location designated by the Owner.

B. Components to be delivered to the owner shall be specifically identified by the owner's representative prior to beginning the demolition.

C. Other items become the property of the Contractor and are to be removed from the site.

END OF SECTION 200400

SECTION 200500 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural and Structural drawings, to the end that complete coordination between trades will be affected. Special attention shall be given to the points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings, and where ducts, piping and conduit must fur into walls, soffits, columns, etc. It shall be the responsibility of the Contractor to leave the necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.

B. The Contractor shall be responsible for coordination with the Electrical trade to insure that he has made provision for connections, operational switches, disconnect switches, fused disconnects, etc. for electrically operated equipment provided under this division of the specifications, or called for on the plans.

C. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other Contracts, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit, and equipment not installed in accordance with the above instructions, and which interfered with work and equipment of other trades.

D. In all areas where air diffusers and lighting fixtures are to be installed, the Contractor shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangements.

2. INTERFACING

The Contractor shall insure that coordination is affected relative to interfacing of systems. Some interface points are (but not necessarily all):

A. Connection of Natural Gas System to natural gas service.

B. Connection of all controls to equipment.

C. Electrical power connections to electrically operated (or controlled) equipment.

3. RECORD DRAWINGS

A. RECORD DRAWINGS - Each Contractor shall insure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on Coordination Drawings kept at

the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the Construction Manager, Owner, Architect and Engineer for their Records.

END OF SECTION 200500

SECTION 201100 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall be responsible for all openings, sleeves, trenches, etc., that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.

C. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at is own expense.

D. The Contractor shall notify other trades in due time where he will require openings or chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

E. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Engineer.

F. All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Contractor at the direction of the trade whose work is affected.

2. SLEEVES, PLATES AND ESCUTCHEONS

A. The Contractor shall provide and locate all sleeves and inserts required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for pipes where sleeves and inserts were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the pipe or conduit and the sleeves shall be made completely and permanently water tight.

B. Pipe that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.

C. At all other locations either pipe sleeves or core drilled openings are acceptable.

D. Where thermal expansion does not occur, the wall may be sealed tight to the pipe or insulation.

E. Insulation, that requires a vapor barrier (i.e., cold water or refrigerant piping, etc.), must be continuous through the sleeve/cored hole. For other piping, insulation may stop on either side of the sleeve.

F. Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints or Schedule 40 pipe. Sleeves in floors shall extend 1" above finished floor level.

G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

H. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.

I. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3. CUTTING

A. All rectangular or special shaped openings in plaster, stucco or similar materials, including gypsum board, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, lighting fixtures, etc.

B. Mechanical, plumbing, and fire protection contractors shall coordinate all openings in new and existing masonry walls with the General Contractor; and, unless otherwise indicated on the Architectural drawings, provide lintels for all openings required for the work (Louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:

(1) New Openings under 48" in width: Provide one 3-1/2" x 3-1/2" x 3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(2) New Openings 48" to 96" in width: Provide one 3-1/2" x 6" x 3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(3) New Openings over 96" in width: Consult the Project Structural Engineer.

C. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.

D. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

E. Openings in metal building walls shall be made in strict accord with building suppliers recommendations.

4. PATCHING AND REPAIRING

A. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.

B. Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced to the satisfaction of the Engineer.

C. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.

D. Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door.

E. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.

F. Stainless steel collars shall be provided around all ducts, large pipes, etc., at all wall penetrations; both sides.

G. Where ducts, pipes, and conduits pass through interior or exterior walls, the wall openings shall be sealed air tight. This shall include sealing on both sides of the wall to insure air does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.

H. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

END OF SECTION 201100

SECTION 201300 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineers. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.

C. All pipe shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted. Spacing of pipe supports shall not exceed eight feet for pipes up to 1-1/4 inches and ten feet on all other piping. Small vertical pipes (1 inch and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. (Refer to Specifications Section entitled INSULATION-MECHANICAL). In metal buildings, support piping with standard pipe hangers with C-clamp connection to main structural members (not purlins), use angle steel cross pieces between main structural members where required to provide rigid support.

D. Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation.

E. In general, piping shall be installed concealed except in Mechanical, Janitor Rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur, they shall be kept as close to walls as possible.

F. Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be 1/2" size gate type with 3/4" hose thread end and vacuum breaker. Label each drain valve.

G. All hot and cold-water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.

H. Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing; if in doubt, consult Engineer.

I. Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and sound practice.

J. All cast iron soil pipe and fittings shall be coated inside and out with coal tar varnish.

K. Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineers.

L. Nipples shall be of the same material, composition and weight classification as pipe with which installed.

M. Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineers prior to submission of a bid proposal.

N. Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If necessary, contact Engineers.

O. Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case, shall be accomplished without use of insulating unions and permission of the Engineers.

P. Apply approved pipe dope (for service intended) to all male threaded joints. Pay particular attention to dope for fuel gas lines. The dope shall be listed for such use.

Q. High points of closed loop hot water heating systems shall have manual or automatic air vents as indicated or required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.

R. All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.

S. The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State which the work is being accomplished in.

T. Provide expansion joints where shown on the plans and where required by good practice. Expansion joints shall be guided and anchored in accordance with the recommendations of the Expansion Joint Manufacturer's Association.

U. Where plastic pipe penetrates a fire rated assembly, it shall be replaced with a metal threaded adapter and a metal pipe per code.

V. Foam Core PVC is not permitted

W. Where piping penetrates interior or exterior walls, the wall shall be sealed air tight. Refer to the sleeving, cutting, patching and repairing section of the specifications for additional requirements.

X. Provide thrust blocks on all storm, sanitary, water, steam, hot, chilled, condenser, etc., and any other piping subject to hammering. Thrust blocks shall be provided at all turns.

Y. All piping to hydronic coils shall be full size all the way to the coil connection on the unit. If control valve is smaller than pipe size indicated, transition immediately before and after control valve. Also, if coil connection at unit is a different size than the branch pipe size indicated, provide transition at coil connection to unit. On 3-way valve applications, the coil bypass pipe shall be full size.

Z. Provide check valves on individual hot and cold-water supplies to each mixing valve (including each sensor style faucet, safety shower, mop sink, etc.) and each showerhead with a diverter valve (including all ADA showers). This requirement shall not be satisfied by mixing valves or fixtures with internal check valves. Independent external check valves are required.

2. UNIONS AND FLANGES AND WELDED TEES

A. Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. Gaskets for steam piping systems shall be flexitalic spiral wound type. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.

B. Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.

C. Tee connections for welded pipe shall be made up with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

3. SPECIFICATIONS STANDARDS

All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:

A. Steel pipe; ASTM A-120, A-53 Grade A, A-53 Grade B.
B. Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
C. Cast iron soil pipe; ASA A-40.l and CS 188-59.
D. Cast iron drainage fittings; ASA B16.12.
E. Cast iron screwed fittings; ASA B16.4.
F. Welding fittings; ASA B16.9.
G. Cast brass and wrought copper fittings; ASA B16.18.
H. Cast brass drainage fittings; ASA B16.23.
I. Reinforced concrete pipe; ASTM-C-76-64T.
J. Solder; Handy and Harmon, United Wire and Supply; Air Reduction Co. or equivalent.
K. CPVC Plastic pipe; ASTM D2846.
L. PVC plastic pipe; ASTM D1785.
M. ABS plastic pipe; ASTM D1788-73.
N. Cross-linked polyethylene (PEX) pipe; ASTM F876 and ASTM F877.
O. Cross-linked polyethylene (PEX) fittings; ASTM F1960

4. PITCH OF PIPING

All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. Refer to the State Plumbing Code for additional requirements. For proper flow and/or for proper operation, the following pitches shall be required:

A. Interior Soil, Waste and Vent Piping:

1/4 inch per foot in direction of flow where possible but in no case less than 1/8" per foot.

B. Exterior Sanitary Lines:

Not less than one (1) percent fall in direction of flow and no greater than indicated.

C. Roof Leaders:

1/8 inch per foot where possible.

D. Condensate Drain Lines from Cooling Equipment:

Not less than 1/4 inch per foot in direction of flow.

E. Exterior Storm Lines:

Not less than 1 percent grade in direction of flow.

F. All Other Lines:

Provide ample pitch to a low point to allow 100 percent drainage of the system.

5. APPLICATIONS

A. General Notes

(1) Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.

(2) Plastic piping or any materials with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.

(3) PVC, CPVC, or plastic piping shall not be used under paving, roads or areas where vehicular traffic is expected.

(4) PVC or plastic piping whether specifically listed or not may not be used in high rise buildings or anywhere else prohibited by code.

B. Sanitary Sewer – Exterior

(1) Service weight cast iron piping with bell and spigot fittings complying with ASTM A 74. All joints shall be compression gasket type.

(2) SDR 35 PVC pipe extruded from Type 1, Grade 1 polyvinyl chloride material. PVC pipe shall have a bell type fitting on one end. All joints shall be solvent cement type, made in accordance with the State Plumbing Code.

(3) Service weight hubless cast iron with manufacturer's approved bands. Bands shall be heavy duty band with extra width for lateral support. Each coupling shall include a minimum for of four bands.

C. Storm Sewer – Exterior

(1) Class II reinforced concrete pipe (RCP) with tongue and groove gasketed joints conforming to ASTM C-443.

(2) Service weight cast iron piping with bell and spigot fittings complying with ASTM A 74. All joints shall be compression gasket type.

(3) SDR 35 PVC pipe extruded from Type 1, Grade 1 polyvinyl chloride material. PVC pipe shall have a bell type fitting on one end. All joints shall be solvent cement type.

D. Natural Gas Piping - Exterior

Exterior natural gas piping shall be thermoplastic gas pressure pipe with fittings complying with ASTM D 2513. All gas piping shall be installed per NFPA 54.

E. Domestic Water Piping - Exterior

(1) Type "K" hard copper with wrought copper fittings and brazed joints.

(2) Schedule 150 ductile iron piping with cement mortar lining and rubber gasketed joints.

(3) Schedule 40 PVC pipe, NSF approved for underground domestic cold-water pipe, with solvent weld joints. All piping and joints shall meet the State Plumbing Code.

(4) Class 200 PVC. Piping shall meet AWWA C900 requirements, be UL listed, Factory Mutual approved and NSF approved. Joints shall have spigot pipe ends with a flexible elastomeric ring seated in a groove to provide water tight seal. Minimum burst pressure to be 900 psi when tested in accordance with ASTM D1599.

F. Fire Protection - Exterior and Interior

Refer to the Fire Protection System section of these specifications.

G. Hydronic Piping – Underground

SELECT A PREINSULATED OR DUCTILE IRON

(1) Class 250 Ductile iron with mechanical joint fittings per ANSI/AWWAC190/A21.10 and ANSI/AWWA C111/A21.11.

(2) General

a. Pre-insulated Piping
Furnish a complete system of factory pre-insulated steel piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the pre-insulated piping system manufacturer. The system shall be Thermafab FERRO-THERM, Perma Pipe or Rovanco.

(3) Products

a. Carrier pipe shall be steel ASTM A-53, Grade B, ERW (Type E) or seamless (Type S), Standard weight for sizes 5” and larger, and shall be ASTM A-120/A-53, continuous weld (Type F), standard weight for sizes 4” and smaller. Seamless pipe smaller than 2” shall be ASTM A-106/A53, Grade B. All steel piping shall have ends cut square and beveled for butt-welding. Straight sections of factory insulated pipe shall have 6” of exposed pipe at each end for field joint fabrication.

b. Polyurethane foam insulation shall be injected with one shot into the annular space between carrier pipe and jacket with a minimum thickness of one inch. Insulation shall be rigid, 90-95% closed cell polyurethane with 2 to 3 pounds per cubic foot density and

coefficient of thermal conductivity (K-factor) of 0.14 and shall conform to ASTM C-591. Maximum operating temperature shall not exceed 250 degrees F.

c. Jacketing material shall be extruded white polyvinyl chloride, consisting of clean, virgin NSF approved Class 12454-B PVC compound, conforming to ASTM D-1784, Type 1 Grade 1. PVC jacket shall have a wall thickness in mils equal to ten times the nominal jacket diameter and shall not be less than 60-mils. High density polyethylene (HDPE), conforming to ASTM D-1248, shall be used for jacketing larger than 20". Wall thickness for HDPE jacketing shall be 90-mils for sizes 8" and smaller, 100-mils for 10"-12", 150-mils for 14"-22", and 225-mils for 24" and larger. Jacketing for above ground, outdoors installations shall contain ultraviolet inhibitors for protection from sunlight. No FRP jacket allowed.

d. Straight run joints are insulated using urethane foam to the thickness specified, jacketed with PVC sleeves and sealed with polyethylene backed, pressure sensitive bituminous rubber tape, 30-mils thick. Above ground installations shall use white, pressure sensitive PVC tape.

e. Fittings are factory prefabricated and pre-insulated with urethane to the thickness specified, jacketed with a PVC fitting cover and then wrapped with polyethylene backed, pressure sensitive bituminous rubber tape, 30-mils thick. Carrier pipe fittings shall be butt-welded, except sizes smaller than 2" shall be socket-welded. Welds shall be radiographically inspected. At the Engineer's option, and for all above ground installations, fittings shall be jacketed using thermally butt-fused mitered sections of the same jacket material used on straight pipe sections. Fittings include expansion loops, elbows, tees, reducers and anchors. Fittings may be field insulated with liquid urethane foam insulation, jacketed with a PVC fitting cover and then wrapped with polyethylene backed, pressure sensitive bituminous rubber tape, 30-mils thick. Above ground installations shall use white, pressure sensitive PVC tape.

f. Expansion/contraction compensation will be accomplished utilizing factory prefabricated and pre-insulated expansion elbows, Z-bends, expansion loops and anchors specifically designed for the intended application. External expansion compensation will be provided utilizing flexible expansion bolsters, extending three feet on either side, both inside and outside the radius of the fittings.

(4) Execution

a. Pre-engineered systems shall be provided with all straight pipe and fittings factory pre-insulated and prefabricated to job dimensions. Field engineered systems shall be provided with factory insulated straight pipe sections and factory prefabricated fittings, or field fabricated fittings insulated with kits provided by the system manufacturer.

b. Underground systems shall be buried in a trench of not less than three (3) feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems.

c. Trench bottom shall have a minimum of 6” of sand, fill material as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer’s installation instructions.

d. A hydrostatic pressure test shall be performed at one and one-half times the normal system operation pressure for not less than two hours. Care shall be taken to ensure all trapped air is removed from the system prior to the test. Appropriate safety precautions shall be taken to guard against possible injury to personnel in the even of a failure.

e. Field service shall be provided by a certified manufacturer’s representative or company field service technician. The technician will be available at the job a minimum of three times to check unloading, storing, and handling of pipe, joint installation, pressure testing and backfilling techniques.

H. Soil Waste and Vent Piping - General Requirements

(1) Water closet floor flanges and ells shall be cast iron regardless whether PVC piping is allowed or not.

(2) Soil and waste piping serving mechanical rooms, laundries and kitchens shall be cast iron regardless whether PVC piping is allowed or not. Cast iron will also be required at any other location where waste water temperature can exceed 120°F. Cast iron shall extend a minimum of 35' past last waste inlet.

I. Soil, Waste and Vent Piping (Below Slab)

(1) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the State Plumbing Code. **Foam core piping is not permitted.**

(2) Service weight hubless cast iron with manufacturer's approved bands.

(3) Waste piping serving Soda Machine drains, (floor sinks or floor drains) shall be: Service weight cast iron epoxy coated no-hub cast iron pipe and fittings, as manufactured by Newage Casting or approved equal. Certified to conform to ASTM A888 & CISPI 301. The two-part epoxy spray on coating shall have a 2.5 mil. Minimum exterior thickness and a 5 mil. Minimum interior thickness for adhesion and chemical resistance. Two-part epoxy is to be tested to be non-reactive from 2pH-12pH. Install piping in accordance to manufacturer's instructions. This branch piping shall run as this material until connected to the main.

J. Soil, Waste and Vent Piping (Above Slab)

(1) Service weight hubless cast iron pipe. Bands shall be heavy duty band with extra width for lateral support. Each coupling shall include a minimum of four bands.

(2) Service weight cast iron hub and spigot piping with compression gasket joints.

(3) Schedule 40 galvanized steel piping with screwed ends and cast-iron drainage pattern fittings for piping 2" and less in size. Provide pipe adapters for connector of cast iron pipe at slab.

(4) Type DWV copper drainage piping with cast bronze drainage pattern fittings with solder joints.

(5) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the State Plumbing code.

K. Roof Leaders/Interior Storm Sewer Piping

(1) Service weight hubless cast iron pipe with manufacturers approved bands. Horizontal pipe and fittings 6" and larger, shall be suitably braced to prevent horizontal movement. Provide bracing in accordance to CIPI 301-00. Provide "Holdrite" bracing system or approved equal.

(2) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints.

L. Sump Pump Discharge

(1) Type "M" copper with solder joints.

(2) Schedule 40 PVC where piping is not installed in a plenum. All piping exposed on the exterior must be copper.

M. Natural Gas Piping – Interior

(1) Schedule 40 black steel pipe with malleable iron threaded fittings for pipe sizes 2" and smaller.
(2) Schedule 40 black steel pipe with wrought steel buttwelded fittings for pipe sizes 2-1/2" and larger.
(3) Where gas pressure is 5 psi or greater, piping shall be schedule 40 black steel pipe with wrought steel buttwelded fittings.
(4) Gas piping on the roof shall have expansion loops on all piping runs 75 feet or greater.

NOTES:

a. All gas piping shall be installed per NFPA 54.
b. Unions or valves shall not be installed in an air plenum.
c. Piping below slab must be sleeved and vented.
d. Piping installed in concealed locations shall not have mechanical joints.

N. Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)

(1) Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).

(2) Victaulic 607 or engineer approved equivalent mechanical grooved pipe couplings and fittings may be used in lieu of solder. For potable water, product shall utilize grade “P” EPDM gasket rated from +0°F to +180°F for improved resistance to chlorine, chloramine and other typical potable water disinfectants. Victaulic 608N may be utilized with copper groove system.

O. Trap Prime Piping

(1) Above slab: It shall match domestic water piping requirements.

(2) Underslab: It shall match domestic water piping requirements with a protective wrap or cross-linked polyethylene (PEX) piping.

P. Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab)

Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs. All piping shall be run in a protective PVC conduit with long bend elbows.

Q. Hydronic Piping (Hot, Chilled, Condenser, Or Heat Pump Systems)

(1) 2" and Smaller: Schedule 40 black steel pipe with screwed fittings or Type "L" hard copper tubing with wrought copper fittings and 95/5 solder.

(2) 2-1/2" and Larger: Schedule 40 black steel pipe with 125# welded or flanged joints. Weldolets may be used for branch line connections to pipe mains. Type "L" hard copper piping with wrought copper fittings and 95/5 solder may be installed.

(3) Victaulic 607 or engineer approved equivalent mechanical grooved pipe couplings and fittings may be used in lieu of solder. Gaskets shall be grade “EHP” EDPM designed for operating temperatures from -30°F to +250°F. Mechanical grooved piping may <u>not</u> be used if system water temperature exceeds 250°F.

(4) Schedule 40 Victaulic 107V/W07 or engineer approved equivalent mechanical grooved pipe couplings and fittings with 125# rating minimum may be used. Housings cast with torque-absorber and shift-limiting slant bold pad design. Install gaskets as recommended by the manufacturer. Piping system shall be rated for minimum of 250°F water temperature. Mechanical grooved piping may <u>not</u> be used if system water temperature exceeds 250°F.

a. Roll grooves in ends of pipe based on pipe and coupling manufacturer’s written instructions, which may or may not include torque settings, torque wrenches, extreme lubricant and specified gaps. Engineer reserves the right to inspect any and all installation of product. Factory trained representative must periodically visit the job site and provide on-site training. Grooved pipe shall be produced using approved method by fitting manufacturer. Confirm all grooved pipe critical dimensions fall into the required tolerance range as listed by the tool manufacturer.

(5) Special Notes:

a. Dielectric unions shall be provided at all connections of dissimilar materials.

b. Copper and steel piping shall not be mixed in the mechanical room.

c. Piping shall meet all State Boiler Code requirements. Pay particular attention to welded pipe requirements for hot water systems.

d. Takeoffs and branch piping to individual coils or heat pumps shall not be connected to the bottom of hydronic mains. Connection to mains shall be at the side of the main. Also refer to details on the drawings.

e. Grooved piping shall not be accepted. (EDIT IF GROOVED PIPE IS ACCEPTABLE)

R. Air Vent Discharge Lines

Type "L" soft copper; wrought copper fittings, 95/5 solder.

S. Refrigerant Piping

Interior Piping for Variable Refrigerant Flow Systems 1/8” to 1-3/8” shall be ACR soft copper tube with long radius bends of soft copper tube. Provide ACR hard copper tube in all sizes for systems other than Variable Refrigerant Flow. Interior lines larger than 1-3/8” shall be ACR hard copper tube. All exterior lines shall be ACR hard copper tube. Fitting shall be wrought or forged copper with silver solder joints and minimum 15% silver content.

(1) General Installation Notes:

a. Contact Engineer 24 hours prior to installation of refrigerant lines or evacuation of refrigerant system.
b. Refrigerant lines installation must meet HVAC equipment manufacturer's recommendations.
c. While installing or soldering refrigerant lines, system must continuously be purged with nitrogen.
d. After system is installed, the refrigerant system must be evacuated to 25 microns for eight hours.

T. Condensate Drain Lines

(1) Type "DWV” copper, wrought copper, lead free solder.

(2) Schedule 40 PVC with solvent welded fittings.

U. Water Heater Relief Line

Type "M" copper tubing with sweat fittings and 95/5 solder.

V. Acid Waste and Vent – Exterior and Interior

(1) Below Slab: Schedule 40 non-flame-retardant polypropylene pipe conforming to ASTM D4101 with joints made in accordance with the State Plumbing Code. Below grade piping shall be installed with fusion joint fittings.

(2) Above Slab, pipe in non-plenum area: Schedule 40 flame retardant polypropylene pipe conforming to ASTM D4101 with joints made in accordance with the State Plumbing Code. Piping shall be installed with fusion joints within concealed spaces and with mechanical joints in accessible areas. All mechanical couplings below casework or exposed shall have the clamp edges smoothed or covered to keep sharp edges from cutting people.

(3) Above slab, pipe in plenum: Schedule 40 PVDF per ASTM F1673 with mechanical joint fittings meeting ASTM E84 for flame spread and smoke generation (less than 25 and 50 respectively).

(4) Piping shall be protected from sunlight in accordance with the manufacturer's recommendations.

(5) Acceptable manufacturers of acid waste and vent piping materials: Blueline (Orion), Enfield (Ipex) or Fuseal (GF Piping Systems).

END OF SECTION 201300

SECTION 202100 - VALVES AND COCKS

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. The Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing cocks, air cocks, lubricated plug cocks, packed plug cocks, special valves for special systems, etc., for all Mechanical Systems.

C. All valves shall be designed and rated for the service to which they are applied.

D. The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

E. Ball valves with temperature and pressure ports are not an acceptable alternative to the balancing valves specified herein. Valves that do not comply with these specifications shall be removed and replaced by the Contractor with no increase in contract price.

F. Each type of valve shall be of one manufacturer, i.e., gate valves, one manufacturer, globe valves, one manufacturer, silent check valves, one manufacturer, etc. The following valve manufacturers shall be acceptable: Lunkenheimer, Tour & Anderssen, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Victaulic, Bell & Gossett, Flow Design, Watts.

G. All valves shall comply with current Federal, State and Local Codes.

H. All valves shall be new and of first quality.

I. All valves shall be full line size. Valves and hydronic specialties shall not be reduced to coil or equipment connection size. Size reductions shall be made at the connection to the equipment.

J. Angle stops for plumbing fixtures shall be quarter turn ball type.

2. WORKMANSHIP AND DESIGN

A. Handwheels for valves shall be of a suitable diameter to allow tight closure by hand with the application of reasonable force without additional leverage and without damage to stem, seat and disc. Seating surfaces shall be machined and finished to insure tightness against leakage for service specified and shall seat freely. All screwed valves shall be so designed that when the screwed connection is properly made, no interference with, nor damage to the working parts of the valve shall occur. The same shall be true for sweat valves when solder or brazing is applied.

B. CHECK VALVES

Check Valves shall be horizontal swing type with two piece hinges, disc construction seats to be bronze and bronze discs or with composition face depending on service and provide silent operation. Valves 1-1/2 inches and smaller shall be bronze with ends to suit piping, have full area "Y" pattern body and integral seats. Valves 2 inches and larger shall be iron body brass mounted and with flanged ends. Working pressure for bronze valves shall be 150 psi and iron valves 125 psi when installed in piping with system pressures up to 100 psi and 250 psi for 100 psi and over. 3" and under NIBCO T433Y, greater than 3" NIBCO F918B (for less than 100 psi systems) greater than 3” NIBCO F968B (for 100 psi or greater systems).

C. BALL VALVES (NON-POTABLE)

Ball Valves shall have removable lever handle with vinyl grip, adjustable stem gland screw, reinforced Teflon stuffing box ring, blow out proof stem, bronze body, reinforced Teflon seats, chrome plated steel ball as manufactured by Consolidated Valve Industries, Inc., Lunkenheimer, Apollo, Jenkins, Nibco or equivalent. Provide a stem extension so that the base of the handle is 1/4" above the insulation. NIBCO T5800-70.

D. GAUGE COCKS

Straight, Lunkenheimer, Fig. 1178; 125#; bronze; tee handle. FIP.

E. LUBRICATED PLUG COCKS

2" and under; Homestead Fig. 601; 150#; semi-steel; screwed; 2-1/2" and over; Homestead Fig. 602; ±50#; semi-steel; flanged.

F. PACKED PLUG COCKS

2" and under; DeZurik Fig. 425-S; 175#; semi-steel; screwed. 2-1/2" and over; DeZurik Fig. 425-F; 175#; semi-steel; flanged.

END OF SECTION 202100

SECTION 202110 - ACCESS TO VALVES, EQUIPMENT, FILTERS, ETC.

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. All mechanical equipment shall be installed in a manner which allows ready access to all components requiring service, adjustments, shutoff, etc.

C. Filters shall be accessible, removable and replaceable without disconnecting mounting brackets, piping, wiring, etc.

D. All oil cups, grease cups, grease fittings, etc. shall be accessible without disassembly of equipment, piping, ductwork, etc. (Extended oilers or grease fittings may be required).

E. Provide access doors or panels for all equipment, valves, dampers, filters, fire dampers, etc. in concealed spaces not otherwise provided with suitable access. (Lay-in ceilings shall be considered acceptable access; splined or drywall ceilings shall not).

F. All valves, unions, strainers, cleanouts, volume dampers, and test points shall be accessible.

G. Access panels in lay-in ceilings shall be labeled with a lamacoid plate to indicate location of equipment, filters, valves, etc.

H. Access panels in fire rated walls shall bear the same rating as the wall.

I. Each fire damper shall be provided access through the duct to allow reset of the damper. This may be either a gasketed sheet metal panel over a suitable opening or a factory built access panel. The panel shall be at least one and one-half (12) inch larger than the opening all around and shall be held in place with sheet metal screws sufficiently to insure that it is air tight. Manually check the size and location of each of these openings to insure that the fire damper may be manually reset by use of hand only.

2. ACCESS DOORS

Refer to Sheet Metal and Flexible Duct section of the specifications.

END OF SECTION 202100

SECTION 202200 - INSULATION - MECHANICAL

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   B. Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.

   C. Application of insulation materials shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use. Insulation shall be applied by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineers shall be removed and properly installed at the expense of the Contractor.

2. MANUFACTURERS

   A. Insulation shall be as manufactured by Manville, Knauf, CertainTeed, Owens-Corning, Armacell or other approved equivalent. Insulation sundries, adhesives, and jackets/covers shall be as made by Benjamin Foster, Zeston, Speedline, Proto, Childers, Vimasco or approved equivalent.

3. FIRE RATINGS AND STANDARDS

   A. Insulations, jackets and facings shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50.

   B. Adhesives, mastics, tapes and fitting materials shall have component ratings as listed above.

   C. All products and their packaging shall bear a label indicating above requirements are not exceeded.

4. GENERAL APPLICATION REQUIREMENTS

   A. Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.

   B. All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vaporseal, where required, will be accepted.

C. "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

D. Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.

E. Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!

F. All insulation shall be installed with joints butted firmly together.

G. The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

5. PIPING SYSTEMS

A. GENERAL

(1) Bevel insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. Note: Applies to hot water lines only; cold water lines require continuous insulation.

(2) Pipe insulation shall extend around valve bodies to ensure no condensation drip or collection.

(3) Factory molded fittings may be installed in lieu of built-up fittings. Jackets to be the same as adjoining insulation. Insulated fittings must have same or better K factors than adjoining straight run insulation.

(4) Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.

(5) Insulation shall not extend through fire and smoke walls. A UL-listed penetration system shall be used for each fire or smoke wall penetration in accordance with KBC. Materials used such as caulk, sleeves, etc. shall be manufactured by 3M, Hilti, or equal.

B. INSULATION SHIELDS

(1) Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

PIPE SIZE	SHIELD GAUGE	SHIELD LENGTH

2" AND LESS	20	12"
2 1/2" TO 4"	18	12"
5" TO 10"	16	18"
12" AND GREATER	14	24"

C. INSULATION MATERIAL (FOR THE FOLLOWING SYSTEMS) **(REVISED @ ADDENDUM 3)**

Insulation shall be Owens-Corning Model 25ASJ/SSL, or approved equivalent fiberglass pipe insulation with **a white all service jacket suitable for painting**. The insulation shall be a heavy density, pipe insulation with a K factor .23 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket approved manufacturers are listed in section 2. Manufacturers. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of .02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturers' recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

(1) Domestic Cold Water, including trap primer piping above slab, Lab High Purity Water, Lab Deionized Water (KDMC Projects – all 1")

a. Piping 3'' or less – use 1/2" thick insulation. Provide an additional ½" layer of insulation 3" above and 3" below vertical pipe supports.
b. Piping 4'' or greater – use 1'' thick insulation.

(2) Hydronic System Fill Lines from Domestic Cold Water - 1/2" thick. (KDMC Projects – 1")

(3) Domestic 110°F Hot Water and 110°F Recirculating Hot Water. (If heat traced, see below)

a. Piping 1 ½'' or less – use 1 ½'' thick insulation.

b. Piping 2'' or greater – use 2'' thick insulation.

(4) Domestic 140°F Hot Water and 140°F Recirculating Hot Water. (If heat traced, see below)

a. Piping 1 ½'' or less – use 1 ½'' thick insulation.

b. Piping 2'' or greater – use 2'' thick insulation.

(5) Condensate Drain Lines.

a. Piping 1 ½'' or less – use 1/2" thick insulation

b. Piping 2'' or greater – use 1'' thick insulation

(6) Hydronic Water – Hot and Chilled

a. Piping 1 ½'' or less – use 1 ½'' thick insulation.

b. Piping 2" and larger - use 2" thick insulation.

(7) Horizontal Roof Leaders.

a. Piping 3'' or less – use 1/2" thick insulation

b. Piping 4'' or greater – use 1'' thick insulation

(8) Refrigerant Liquid and Suction Lines - Interior & Exterior

IMCOA, Nomaco, or Armacell closed cell polyethylene, 1.5 Lbs/Ft^3 density, 0.24 BTU-Hr.-Ft^3-°F/in at 75°F thermal conductivity, zero vapor permeance, 25/50 flame and smoke spread per NFPA 90 requirements. Elastomeric closed cell insulations that meet the above requirements are also allowed. Install insulation per the manufacturer's requirements. Provide UV protective coating for all exterior refrigerant lines.

a. All pipe sizes: 1 ½'' thick

D. JACKETS

(1) Exposed (Mechanical Rooms, Interior Finished Rooms and Storage Rooms)

All insulated piping installed in the above areas shall have a canvas or PVC jacket:

~~**a. 6 oz. canvas jacket with fire retardant lagging. Apply to the insulation specified for the piping.**~~

b. For all systems except steam, plenum rated PVC jacket equal to LoSmoke PVC jacket with flame/smoke rating of 25/50, ASTM-E84 test method. Minimum thickness 0.04 inches. Steam systems shall utilize plenum rated CPVC jacket with minimum thickness of 0.04 inches. Jackets shall be applied over top of specified pipe insulation. Approved equal manufacturers are Zeston and Speedline. Approved equal manufacturers are Zeston and Speedline.

(2) Exposed (Exterior)

In addition to the insulation specified for the exterior pipe, provide .016" aluminum jacket or PVC jacket 0.05" thick. The jackets shall be installed as recommended by the manufacturer to maintain water tight seal. All longitudinal and transverse seams to be sealed water tight. PVC jacket shall be Ceel-Co, Proto, or Zeston.

(3) Exposed (Interior) (ADDED @ ADDENDUM 3)

In addition to the insulation specified for all interior piping, based on system/size, provide 6 oz. canvas jacket with fire retardant lagging. Canvas jacket shall be colored, at the factory, if possible. Canvas shall not be painted in the field, if avoidable. All colors shall be selected by architect.

6. DUCTWORK SYSTEMS

A. GENERAL

(1) Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.

(2) Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection. The backs of all supply diffusers, plenums, grilles, etc. shall be insulated only if indicated by details on the drawings.

(3) All flexible duct connections on insulated ductwork shall be externally insulated.

(4) All duct outside of building envelope, including rooftop duct, duct in unconditioned attic spaces above the insulation, etc. shall have two layers of specified insulation. This shall apply to supply air, exhaust air where air is run through energy recovery unit, outside air, return air, and combustion air intake ducts.

B. EXTERNAL INSULATION

(1) Supply Air
(2) Return Air
(3) Outside Air
(4) Exhaust Air
(5) Boiler Combustion Air
(6) Flexible Duct Connections on Internally Lined Ducts

Owens/Corning “Faced Duct Wrap - Type 100", or approved equal, 2" thick fiberglass duct wrap, 1.0 pcf density factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. Flame spread 24, smoke developed 50, vapor barrier performance 0.02 perms per inch. K factor shall not exceed .26 at 75°F. mean temperature. Minimum R-value of the 2” thick insulation shall be 7.4 out of package and 6.0 installed.

Special Notes:

a. Do not provide externally insulated duct per the above specification for any duct that is to be painted. Insulated duct that is to be painted shall be dual wall ductwork per specification Section 231200, Sheet Metal and Flexible Duct.
b. Where supply, return, and outside air ductwork is routed through an unconditioned attic or any other space outside of the building thermal envelope, the ductwork shall be provided with a minimum of 2 layers of duct wrap for a minimum R value of 11.0. Additionally, this shall apply to exhaust ductwork on entering side of energy recovery type air handling units.

C. INTERNAL INSULATION

(1) Supply Air
(2) Return Air
(3) Outside Air
(4) Exhaust Air

Duct liner shall be 1 ½'' thick Permacote Linacoustic fiberglass, Owens/Corning, duct liner with factory-applied edge coating or approved equivalent. The liner shall meet NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than .70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .25 mean temperature. Minimum R-value of the 1 ½'' thick insulation shall be 5.7. All exposed fiberglass edges shall be sealed with super seal duct butter or edge treatment products in accordance with the manufacturer's recommendations. DELETE THE FOLLOWING IF NOT A MEDICAL FACILITY. Note: Ductwork for medical facilities in patient areas shall not be internally insulated. They shall be externally insulated.

D. INTERNAL INSULATION DUCTWORK

(1) High velocity rectangular supply air.

a. Duct liner shall be 1 ½'' thick Owens/Corning, fiberglass duct liner with factory-applied edge coating or approved equivalent. The liner shall meet NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than .70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .25 mean temperature. Minimum R value 6.0. All exposed fiberglass edges shall be sealed with super seal duct butter or edge treatment products in accordance with the manufacturer's recommendations.

The insulation shall be pinned to the duct per the manufacturer's recommendations for system air velocity. The black coated surface of the insulation shall face the air stream. The insulation liner shall receive an 100% coverage of adhesive to aid in attaching liner to the sheet metal. Provide metal nosing of the liner on the leading edge when system velocity exceeds 4000 FPM.

E. EXPOSED EXTERNALLY INSULATED DUCT **(REVISED @ ADDENDUM 3)**

(1) Round. 1 ½'' semi-rigid fiberglass tank and pipe wrap with kraft aluminum foil all service jacket vapor barrier or PSK facing. K=.27 @ 75°F. Minimum R-value shall be OK. Provide 6 oz. canvas jacket with fire retardant lagging. **Canvas jacket shall be colored, at the factory, if possible. Canvas shall not be painted in the field, if avoidable. All colors shall be selected by architect.**

(2) Rectangular. 1" rigid fiberglass industrial board with foil scrim kraft vapor barrier facing or PSK facing, 6.0 PCF density, K=.22 @ 75°F. Owens/Corning type 705. Provide 6 oz. canvas jacket with fire retardant lagging. **Canvas jacket shall be colored, at the factory, if possible. Canvas shall not be painted in the field, if avoidable. All colors shall be selected by architect.**

F. EXTERNALLY INSULATED DUCT – OUTDOORS

(1) 2" semi-rigid fiberglass industrial board with foil scrim kraft vapor barrier facing or PSK Facing, 3.0 PCF density, K=.23 @ 75°F. Minimum R-value of 8.7. Owens/Corning, or approved equivalent industrial installation type 703.

(2) Provide a field applied aluminum jacket meeting the following specification:

Aluminum Jacket Material: Smooth finished sheets manufactured from 0.024-inch-thick aluminum alloy complying with ASTM B209 and having an integrally bonded 10mil thick, heat-bonded polyethylene and kraft paper moisture barrier over entire surface in contact with insulation.

Aluminum Jacket Applications: Apply aluminum jacketing to all external ductwork that is externally insulated. Cover all fittings and specialties with aluminum jacketing. Provide a 2-inch overlap at longitudinal seams and end joints. Secure jacket with stainless-steel sheet metal screws 6 inches o.c. and at end joints. Overlap longitudinal seams arranged to shed water and seal end joints with weatherproof mastic.

G. INTERNALLY INSULATED DUCT – OUTDOORS

(1) In addition to the specified internal insulation, weatherproof ductwork with ductmastic adhesive and sealer, Cadoprene 725 as manufactured by Epolux Manufacturing Corp., or approved equivalent.

H. EXPOSED INTERNALLY INSULATED DUCT (ADDED @ ADDENDUM 3)

(1) ROUND. 1" FIBROUS GLASS LINER COMPLYING WITH ASTM C 1071, NFPA 90A, OR NFPA 90B; AND WITH NAIMA AH124. K = 0.22 @ 75°F. COAT INSULATION WITH ANTIMICROBIAL COATING. COVER INSULATION WITH POLYESTER FILM COMPLYING WITH UL 181, CLASS 1.

(2) RECTANGULAR. 1" FIBROUS GLASS LINER COMPLYING WITH ASTM C 1071, NFPA 90A, OR NFPA 90B; AND WITH NAIMA AH124. K = 0.22 @ 75°F. COAT INSULATION WITH ANTIMICROBIAL COATING. COVER INSULATION WITH POLYESTER FILM COMPLYING WITH UL 181, CLASS 1.

7. MECHANICAL EQUIPMENT

A. ROOF DRAIN SUMPS

(1) Owens-Corning Model 475-FR or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a K factor of .22 at 75°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.

B. FLOOR DRAIN SUMPS (Applies to all Floor Drains which Receive Air Conditioning Condensate and which are Installed in Locations Other Than Slab on Grade)

(1) Owens-Corning Model 475-FR or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a K factor of .22 at 75°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.

C. EXPANSION TANK, COMPRESSION TANK, AIR SEPARATOR, HEAT EXCHANGER, SIDESTREAM/LOOP FILTERS, AND HOT WATER STORAGE TANKS

(1) Owens-Corning "Tank Wrap I" or approved equivalent. Insulation shall be constructed of non-combustible, flexible wool. Insulation shall be 2" thick. K factor shall be .29 at 100°F. mean temperature. Insulation shall be attached in strict accordance with the manufacturer's recommendations. All insulation shall be jacketed with 6 oz. canvas with fire retardant lagging. Coordinate with mechanical contractor to extend all piping connections, blowdown ports, etc. outside of the insulation. Additionally, for loop filters and other equipment requiring periodic service, provide removable insulated covers.

END OF SECTION 202200

SECTION 202300 - THERMOMETERS & OTHERS, MONITORING INSTRUMENTS

1. GENERAL

   A. The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated.

2. THERMOMETERS AND PRESSURE GAUGES

   A. All thermometers and gauges shall be readable from a standing position on the floor.

   B. Thermometers shall be linear, alcohol filled, graduated in 1°F. Or less and shall have adequate range for service intended.

   C. Pressure gauges shall be Bourdon Type, circular, 3" face, black letters on white face graduated in 2 PSI or less and shall have adequate range and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks.

   D. Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc., with flexible tubing.

   E. Mount thermometers in approved wells and install with thermal grease. Do not make direct contact of base with fluid in pipe.

   F. Gauges and thermometers shall be Marsh, Marshalltown, Weksler or equivalent.

3. Provide, when indicated on the plans, on the inlet and outlet of each terminal unit, a “Pete’s Plug” or equivalent pressure/temperature test station. Furnish two (2) matching thermometers and pressure gauges to the owner upon project completion.

END OF SECTION 202300

SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. VALVE TAGS AND CHARTS

A. Provide and install on each valve in the Mechanical Systems a 1-1/2" diameter circular brass tag fitted to each valve so that it cannot be removed. Each tag shall be embossed consecutively with letter and number identifiers as to system and purpose respectively. Letter identifiers shall be as follows:

HW	Heating
CHW	Cooling
DCW	Domestic Cold Water
DHW	Domestic Hot Water
DHWR	Domestic Hot Water Recirculation
FP	Fire Protection
NG	Natural Gas

Number identifiers shall be determined by the Contractor sequentially.

B. Provide three (3) copies of typewritten valve charts indicating each valve identifier, the valves purpose and its location. For example: "HC-1 Fan Coil Maintenance Stop-one valve at supply and return of each fan coil unit." One (1) copy of this chart shall be mounted in a durable frame(s) with clear plastic covers in a conspicuous location in the Mechanical Room; or where specified by owner. Two other copies shall be turned over to the Engineers.

C. Where more than one major Mechanical room is indicated for the project, install mounted valve schedule in each major Mechanical Room, and repeat only main valves which are to be operated in conjunction with operations of more than single Mechanical Room.

3. PIPING IDENTIFICATION

A. GENERAL

(1) All exposed piping installed shall be painted according to the color coding chart hereinafter specified. In addition, provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract after the piping has been painted. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. At the Contractor's option, Setmark or equivalent manufactured

marking system may be substituted for field marking. The following table describes the size of the color field and size of the identification letter which shall be used for pipes of different outside pipe diameters.

OUTSIDE DIAMETER OF PIPE OR COVERING	LENGTH OF COLOR FIELD	SIZE OF LETTERS
INCHES	INCHES	INCHES
3/4 TO 1-1/4	8	1/2
1-1/2 TO 2	8	3/4
2-1/2 TO 6	12	1-1/4
8 TO 10	24	2-1/2
OVER 10	32	3-1/2

(2) "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Pipng and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

(3) All piping shall be marked not less than every 15 linear feet above a ceiling system, every 10 feet in a mechanical room, and at all points where lines pass through walls or floors.

(4) Provide pipe marker colors as indicated in the following table where manufactured marking systems are used:

PIPE+	MARKER COLOR+	ABBREVIATION
Chilled Water Supply	Green with Black Letters	C.W.S.
Chilled Water Return	Green with Black Letters	C.W.R.
Condenser water supply & return	Slate Grey with White Letters	C.D.W.S. & C.D.W.R
Hot Water Supply	Yellow with Black Letters	H.W.S.
Hot Water Return	Yellow with Black Letters	H.W.R.
Domestic Cold Water	Green with Black Letters	D.C.W.
Domestic Hot Water	Yellow with Black Letters	D.H.W.
Recirculated Hot Water	Green with Black Letters	R.H.W.
Compressed Air	Blue with White Letters	C.A.
Propane Gas	Yellow with Black Letters	PROP. GAS
Sanitary Sewer Piping	Green with Black Letters	SAN.
Sanitary Vent Piping	Green with Black Letters	VENT
Storm Sewer Piping	Green with Black Letters	STORM
Fire Protection Water	Red with White Letters	F.P.

4. PAINTING (REFER ALSO TO ARCHITECTURAL SECTION ON PAINTING)
   A. GENERAL

(1) All exposed piping installed shall be painted according to the color coding chart hereinafter specified.

(2) "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

(3) Paint all equipment and metal surfaces which are not factory finished (and all damaged or rusted surfaces) in high grade rust proofing machinery enamel. Pay particular attention to flanges, valves, unions, etc., where condensation may collect.

(4) Paint exposed pipe (whether insulated or bare) and exposed surfaces (tanks, etc.).

(5) All piping shall be painted in accordance with the following color coding chart:

PIPE+	PIPE COLOR CODE+	ABBREVIATION
Chilled Water Supply*	Green with Black Letters	C.W.S.
Chilled Water Return*	Green with Black Letters	C.W.R.
Hot Water Supply*	Yellow with Black Letters	H.W.S.
Hot Water Return*	Yellow with Black Letters	H.W.R.
Domestic Cold Water	Green with Black Letters	D.C.W.
Domestic Hot Water	Yellow with Black Letters	D.H.W.
Recirculated Hot Water	Green with Black Letters	R.H.W.
Compressed Air	Blue with White Letters	C.A.
Propane Gas	Yellow with Black Letters	PROP. GAS
Sanitary Sewer Piping	Green with Black Letters	SAN.
Sanitary Vent Piping	Green with Black Letters	VENT
Storm Sewer Piping	Green with Black Letters	STORM
Fire Protection Water	Red with White Letters	F.P.

* Includes pumps, air separator, valves, compression tanks, etc.

+ Where a pipe is not specifically identified in this table, painting and marking shall be in accordance with the most recent ANSI Standards.

B. Water heaters, storage tanks, heat exchangers, etc., shall be painted light gray.

C. All piping shall be marked. Piping shall be marked not less than every 15 linear feet above a ceiling system, every 10 feet in a mechanical room, and at all points where the piping passes through wall or floors.

5. EQUIPMENT IDENTIFICATION

A. All equipment, except in finished rooms, shall be identified by stenciling the title of the equipment as taken from the plans in a position that is clearly visible from the floor. The letters shall be made with black paint and shall be not less than two inches high. The titles shall be short and concise and

abbreviations may be used as long as the meaning is clear. Lamacoid plates are also acceptable. In finished rooms or outdoors, equipment shall be identified by engraved nameplates.

6. DUCTWORK IDENTIFICATION

   A. All ductwork shall be identified as to the service of the duct and direction of flow. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts need not be identified.

7. ACCESS THROUGH LAY-IN CEILINGS

   A. Mark the ceiling T-bar nearest the ceiling panel access to equipment, valves, damper, filter, duct heaters, etc., with a small red lamacoid plate with name of item above ceiling.

END OF SECTION 202400

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Provisions - Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Each Contractor's attention is also directed to Section 201300, Pipe, Pipe Fittings and Pipe Support.

C. This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.

D. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

2. MATERIALS AND EQUIPMENT

A. Hangers, Clamps, Attachments, Etc.:

	SIZE	**SPECIFICATION**
1. Pipe Rings	2" pipe and smaller	Adjustable swivel split ring or split pipe ring, Grinnell Figures 104 and 108, Elcen, Fee & Mason, or approved equivalent.
2. Pipe Clevis	2-1/2" pipe and larger	Adjustable wrought Clevis type, Grinnell Figure 260, Elcen, Fee & Mason, or approved equivalent.
3. Pipe Clevis	All	Steel Clevis for insulated pipe, Elcen Figure 12A, Grinnell, Fee & Mason or approved equivalent.
4. Rise Clamps	All	Extension pipe or riser clamp, Grinnell Figure 261, Elcen, Fee & Mason or approved equivalent.
5. Beam Clamps and Attachments	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason, or approved equivalent. Malleable beam clamp with extension piece figure 229; I-beam clamp figure 131; C-clamp figures 83, 84, 85, 86, 87, and 88.
6. Brackets	All	Welded steel brackets medium weight,

		Grinnell Figure 195, Elcen, Fee & Mason or approved equivalent.
7. Concrete Inserts	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason or approved equivalent. Wrought steel insert Figure 280 and wedge type insert Figure 281.
8. Concrete Fasteners	All	Self-drilling concrete inserts, Phillips, Grinnell, Elcen or approved equivalent.
9. Ceiling	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Pipe hanger flange Figure 153, adjustable swinging hanger flange Figure 155, ceiling flanges Figures 128 and 128R, and adjustable ceiling flange Figure 116.
10. Rod Attachments	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Extension piece Figure 157, rod coupling Figure 136, and forged steel turnbuckle Figure 230.
11. U-Bolts	All	Standard, U-bolt, Grinnell Figure 137, Elcen, Fee & Mason, or approved equivalent.
12. Welded Pipe Saddles	All	Pipe covering protection saddle sized for thickness of insulation, Grinnell Figure 186, Elcen, Fee & Mason or approved equivalent.
13. Pipe Roll	All	Adjustable swivel pipe roll, Grinnell Figure 174, Elcen, Fee & Mason, or approved equivalent.
14. Protection Saddle	All	18 gauge sheet metal pipe protection saddle, Elcen Figure 219, Fee & Mason, Power Strut, or approved equivalent.
15. Hanger Rods	All	Steel, diameter of the hanger threading, ASTM A-107.
16. Miscellaneous Steel	All	Steel angles, rods, bars, channels, etc., used in framing for supports and fabricated brackets, anchors, etc., shall conform to ASTM-A-7.

17. Concrete Channel Inserts	All	Continuous slot inserts, Unistrut, or approved equivalent. Heavy duty Series P-3200 or Light Duty Series P-3300 as required.
18. Adjustable Spot Insert	All	Adjustable spot insert Unistrut, or approved equivalent, P-3245. Design load 1000 lbs.

3. INSTALLATION

A. Unless otherwise specifically indicated or hereinafter specified in the specifications, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be done by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs:

(1) Supporting and hanging shall be done so that excessive load will not be placed on any one hangers so as to allow for proper pitch and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns and branches.

(2) For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.

(3) Trapeze hangers shall be supported by steel rods of sufficient diameter to support piping from joists or concrete construction. Where desired or required, piping may be double mounted on trapeze hangers. Where conditions permit, trapeze hangers may be surface mounted on exposed joists by means of approved beam clamps, or to concrete construction by means of approved adjustable inserts or expansion anchors.

(4) Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.

(5) Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.

(6) Where piping, etc., is run vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

(7) Where piping is run along walls, knee braced angle frames or pipe brackets with saddles, clamps, and rollers (where required) mounted on structural brackets fastened to walls or columns shall be used.

(8) Support all ceiling hung equipment, with approved vibration isolators.

(9) Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

(10) Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.

(11) All insulated piping shall be supported with clevis type and/or pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

(12) Under no conditions will perforated band iron or steel wire driven hangers be permitted.

(13) In general, support piping at the following spacing:

a. Steel and copper piping - 5 feet intervals for piping 3/4" and smaller. 6 feet intervals for 1 ¼" and 1" pipe. 8 foot intervals for piping 1 ½" to 3". 10 foot intervals piping 3 ½" and larger.

b. PVC piping – 4 foot intervals for piping 1 1/2" and smaller. 5 foot intervals for 2 and 2 ½" piping. 6 foot intervals for 3" pipe and larger.

c. Where the manufacturer of the pipe has more strict guidelines, the manufacturer's recommendations shall be followed.

END OF SECTION 202500

SECTION 202600 - MECHANICAL/ELECTRICAL VIBRATION CONTROLS

1. GENERAL

A. RELATED DOCUMENTS

(1) Drawings and general provisions of the Contract, including General and Supplementary Conditions, General Mechanical Provisions and Division 1 Specifications Sections, apply to this section.

B. MANUFACTURERS

(1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
Mason Industries
Vibration Eliminator Co., Inc.
Vibration Isolation Co., Inc.
Kinetics Noise Control
Vibration Management Corporation - Vimco

C. SUMMARY

(1) This Section includes vibration isolators for mechanical and electrical equipment, duct and piping systems.

D. SUBMITTALS

(1) Product Data: Indicate types, styles, materials, and finishes for each type of isolator specified. Include load deflection curves.

2. PRODUCTS

A. VIBRATION ISOLATORS

(1) Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top-and baseplates. Factory drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.

(2) Restraint Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.

(3) Housing: Welded steel or ductile iron. Factory-drilled baseplate for bolting to structure and bonded to a 1/4 –inch-(6mm) thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.

(4) Outside Spring Diameter: Not less than 80 percent of the compressed height of spring at rated load.

(5) Minimum Additional Travel: 50 percent of the required deflection at rated load.

(6) Lateral Stiffness: More than 0.8 times the rated vertical stiffness.

(7) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

(8) Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.

(9) Vertical Limit Stops: Where required or shown, provide resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed.

(10) Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.

(11) Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.

(12) Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

(13) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

(14) Minimum Additional Travel: 50 percent of the required deflection at rated load.

(15) Elastomeric Element: Molded, oil-resistant rubber or neoprene.

(16) All-directional acoustical pipe anchor shall consist of two sizes of steel tubing separated by a minimum ½" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction.

(17) Seismic solid braces shall consist of steel angles or channels to resist seismic loads with minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connection shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage pre-approval "R" number OSHPD in the state of California verifying the maximum certified load ratings.

(18) Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to

pass through. The anchor should be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping anchors shall be attached to the structural slab using stud wedge anchors.

(19) Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that was “rolled up” to create the thread. The stud anchor shall also have a safety shoulder, which fully support the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying its allowable loads.

(20) Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads.

B. VIBRATION ISOLATION BASES

(1) Fabricated Steel Bases: Structural-steel bases and rails designed and fabricated by the isolation equipment manufacturer. Include equipment static loadings, power transmission, component misalignment, and cantilever loadings.

(2) Fabricate bases to shapes required, with welded structural-steel shapes, plates and conforming to ASTM A 36 (ASTM A 36M). Include support brackets to anchor base to isolators units. Include pre-located equipment anchor bolts and auxiliary motor slide bases or rails.

(3) Design and fabricate bases to result in the lowest possible mounting height with not less than an inch (25-mm) clearance above the floor.

(4) Concrete-Filled Inertia Bases: Weld reinforcing bars to the structural frame. Pour concrete into base with relocated equipment anchor bolts.

(5) Weld steel angles on frame for outrigger isolation mountings, and provide for anchor bolts and equipment support.

(6) Configure inertia bases to accommodate equipment supported.

(7) Pump Bases: Size to support pump and piping elbows.

(8) Factory Finish: Manufacturer’s standard corrosive-resistant finish.

3. EXECUTION

A. INSTALLATION

(1) Install and anchor vibration -control products according to manufacturer’s written instructions and authorities having jurisdiction.

END OF SECTION 202600

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

1. GENERAL

A. The General Conditions, Instructions to Bidders, Section 200100, and other Contract Documents are a part of this specification and shall be binding on all Mechanical Contractors. It shall be each Contractor's responsibility to apprize himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.

B. The Engineer, or his authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these specifications or required by others. Any leaks or imperfections found shall be corrected and a new tests run to the satisfaction of the Engineer or his authorized representative. Upon completion of a test, a written approval of that part of the work will be given to the Contractor. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow his work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

2. PLUMBING

A. Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

B. Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.

C. The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.

D. Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.

E. After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one-inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.

F. Thermometers and gauges shall be checked for accuracy. If instruments prove defective, they shall be replaced.

G. The Contractor shall perform all additional tests that may be required by the local Department of Health or other governing agency.

H. Set temperature control on water heaters and adjust tempering valves as required.

I. Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM.

J. Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

K. The compressed air system shall be tested for leaks for eight (8) hours at 250 PSI.

L. The natural gas and/or propane piping shall be tested in accordance with requirements and/or recommendations of the local gas company.

3. HEATING, VENTILATING AND AIR CONDITIONING

A. The test and balance of this system shall be by a contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The test and balance contractor shall report all deficiencies to the engineer.

B. The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.

C. All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated. Provide all start-up documents to Designer prior to any test and balance services.

D. System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.

E. All fan belts shall be adjusted for proper operation of fans.

F. All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.

G. For the purpose of placing the heating, ventilating and air conditioning system in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council. The following systems shall be test and balance:

(1) The supply, return, exhaust, and outside air duct systems associated with all air handling units, rooftop units, and energy recovery ventilators. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the air handling unit. Show accurate representation of return, relief, outdoor and economizer damper locations. On units equipped with return air fans; show location and profile of the return fan.

(2) Duct air leakage testing per Section 231200.

(3) The chilled water pumps and chilled water coils.

(6) The hot water pumps and hot water coils.

(7) Set the minimum and maximum air flow rates for each VAV and CAV box.

(8) Balance all supply, return and exhaust air grille to within 10% of design air flow rate.

(9) Balance all exhaust air fans and record inlet static pressure.

(11) Balance the kitchen range hood supply/exhaust air system.

(12) Balance domestic hot water return system including all balance valves and record settings and flows.

(13) Pressure test ductwork if required by sheet metal specification section 231200.

(14) Provide pre-construction test information on the following systems (_____). Information required is existing AHU air flow rate and static pressure profiles. Determine CFM of each diffuser in project renovation area. Provide 15 duct static pressure measurements where requested by engineer. **(Designer – you need to determine when this paragraph is applicable and edit/make specific this paragraph as required.)**

(15) Adjust all adjustable diffusers to minimize air drafts and eliminate suspended light fixture sway. Furthermore, adjustable diffusers in spaces with ceilings taller than 9 feet shall be adjusted to eliminate air stratification during heating season.

H. Provide a preliminary test report to the mechanical engineer immediately after the system is air balanced, or any initial phases are balanced. This report ***may not*** be hand written. Anticipate visiting the site again after the engineer has reviewed the report. The engineer may request up to 15 additional static pressure measurements for any air handling system to help resolve any balancing deficiencies. Include five additional static pressure measurements for each exhaust air system.

I. The Test and Balance agency shall provide lifts, scaffolding, etc. as required to balance devices in areas with high ceilings such as gymnasiums, auditoriums, atriums, cupolas, etc. The Test and Balance agency may coordinate with the General Contractor or Mechanical Contractor to

arrange for these items to be provided to access high devices, however, it is emphasized the Contractor is finally responsible for providing the means required to balance all devices.

J. Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

K. Test and Balance agency is to provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor will purchase and install all sheaves and belts as required. This includes new and existing equipment.

L. Four (4) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.

M. The Contractor shall provide and coordinate their work in the following manner:

(1) Provide sufficient time before final completion date so that tests and balancing can be accomplished.

(2) Provide immediate labor and tools to make corrections when required without undue delay.

N. The Contractor shall put all heating, ventilating and air conditioning systems and equipment and range hood system into full operation and shall continue the operation of same during each working day of testing and balancing.

O. The test and balance contractor shall be present during the Engineer's final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

P. Balance all water and air systems. Be sure to include:

(1) Domestic Hot Water Recirculating System.

Q. Automatic Flow Control Balance Valves

(1) Verify that each installed automatic flow control device matches the GPM indicated on the drawings.

(2) Verify that the actual pressure at each automatic flow control device is within the pressure limits specified by the valve manufacturer.

4. BUILDING AIR TIGHTNESS TEST

A. The fan pressurization test to determine final compliance with the air tightness requirement shall be conducted when all components of the air barrier system have been installed and inspected, and have passed any intermediate testing procedures as detailed in the construction drawings and specifications. The test may be conducted before finishes that are not part of the air barrier system have been

installed. For example, if suspended ceiling tile, interior gypsum board, or cladding systems are not part of the air barrier system, the test may be conducted before they are installed.

B. Test Requirements

(1) The air leakage test must be performed in accordance with ASTM E 779 with the following additions and exceptions:

(2) The test consists of measuring the flow rates required to establish a minimum of 12 positive and 12 negative building pressures. The lowest test pressure shall be 0.1 in wg; the highest test pressure shall be 0.3 in wg; and there must be at least 0.1 in wg difference between the lowest and highest test pressures.

(3) The test pressure must be measured in a representative location such that pressures in the extremities of the enclosure can be shown to not exceed 10% of the measured test pressure. At least 12 bias pressure readings must be taken across the envelope and averaged over at least 20 seconds each before and after the flow rate measurements. None of the bias pressure readings must exceed 30% of the minimum test pressure when testing in both directions.

(4) Where it can be shown that it is impossible to test in both directions, then the building may be tested in the positive direction only, provided the bias pressure does not exceed 10% of the minimum test pressure.

(5) The mean value of the air leakage flow rate calculated from measured data at 0.3 in wg must not exceed 0.25 CFM per square foot of envelope area. Measurements must be referenced at standard conditions of 14.696 PSI and 68F.

(6) The test shall be conducted with ventilation fans and exhaust fans turned off and the outdoor air inlets and exhaust outlets sealed (by dampers or masking). The contractor must provide a responsible HVAC technician with the authority to place the HVAC system in the correct mode for the pressure test. The test technician must have unhindered access to mechanical rooms, air handlers, exhaust fans, and outdoor air and exhaust dampers.

(7) The contractor must ensure that all windows in the enclosure are kept closed. Entry and exit through doors in the test enclosure must be prohibited during the test. Data collected while the pressures and flows are affected by a door opening and closing shall be discarded.

(8) The testing agency is required to perform a diagnostic evaluation in accordance with ASTM E 1186, whether the building achieves the air tightness requirement or not. The diagnostic evaluation will assist the contractor and responsible parties in identifying and eliminating air leakage so the building meets the requirement upon retesting. The testing results will also be expressed in terms of the Equivalent Leakage Area (EqLA) at 0.3 in wg. The EqLA is the equivalent area of a flat plate that leaks the same amount as the building envelope at 0.3 in wg.

(9) A report shall be provided to Engineer and Architect after the first Air Tightness Test and the first diagnostic evaluation. After corrective measures are taken by the appropriate subcontractors, a second and final test Air Tightness Test shall be provided by the testing agency. A diagnostic evaluation shall again be provided after the second Air Tightness Test, should the second Air Tightness test reveal the building still does not meet air tightness requirements.

(10) Any subsequent testing and evaluation after the second Air Tightness Test and second diagnostic evaluation shall be considered additional scope, and the cost of which shall be paid by the responsible party.

5. FIRE PROTECTION SYSTEM

A. Test in accord with local Fire Marshall requirements and/or requirements or recommendations of NFPA Regulations.

END OF SECTION 203100

SECTION 203200 - MECHANICAL MAINTENANCE

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. MECHANICAL MAINTENANCE CONTRACT

A. In addition to all other work indicated and specified, the Contractor shall provide the necessary skills and labor to assure the proper operation and to provide all required current preventative maintenance for all equipment and controls provided under Division 20 for a period of one year after substantial completion of the contract as defined in these specifications.

B. The Contractor shall receive calls for any and all problems experienced in the operation of the equipment provided and shall take steps to immediately correct any deficiencies that may exist.

C. The Contractor shall provide monthly inspection of all equipment and record the findings on a check list hereinafter specified.

D. The Contractor shall provide a check list and shall post a copy of it in the main mechanical room. The check list shall be a list of each piece of equipment found in Division 20 of these specifications. The check list shall have a space for each of the next 12 months to provide a space for check-off. The Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, it has been properly lubricated, and that all necessary current and preventative maintenance has been performed as recommended by the manufacturer and by good and accepted practice. This check list shall be approved in writing by the Engineers.

E. All equipment that requires repairing shall be immediately serviced and repaired. Since the period of maintenance runs for one year concurrently with the warranty and guarantee, all parts and labor shall be furnished at no extra cost to the Owner.

F. Control System - Once each month, the Control Sub-Contractor shall check all controls in the building to ascertain that they are functioning as designed and installed. This shall apply to all thermostats, aquastats, humidistats, freezestats, and firestats. This portion of the work shall be performed only by the Sub-Contractor that installed the controls.

G. Filter maintenance shall be a special part of this contract and this Contractor shall inspect all filters once every month and shall clean or replace filter as necessary.

H. When emergency service is required beyond regular working hours to maintain the system in operation, the Contractor shall furnish such service.

I. Failure on the part of the Contractor to comply with all or part of this section of his work, will be required to relinquish a portion of his original contract sum. In general, that cost will be determined by the cost incurred by the owners to have work accomplished which should have, by contract, been accomplished by the Contractor.

END OF SECTION 203200

SECTION 210100 - FIRE PROTECTION SYSTEM

1. GENERAL

A. The General Conditions, Instructions to Bidders, Section 200100, 1. A, and other Contract Documents are a part of this specification and shall be binding on the Contractor. It shall be the Contractor's responsibility to apprise himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.

B. No Contractor, other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems, will be considered or approved for the work under this section of the specifications. Bidders must have had not less than five (5) years experience in the fabrication and erection of such systems: wet, dry and rack storage types, and shall have completed installations similar and equivalent in scope to this system under approval by one or more of the recognized Underwriting Associations in the Insurance Field.

C. Before submitting bid, examine all Mechanical, Architectural, and Structural Drawings, visit the site and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work. Also, the Contractor shall coordinate with the rating bureau and insuring agency to verify adequacy of water supply for the proposed sprinkler system extension.

D. The Contractor shall take his own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Where variations exist between described work and approved practice, the Engineer shall be consulted for directive.

E. It is the intent of the Plans and Specifications to provide a general layout only and locate major equipment, piping, etc. Variations in head locations, pipe routing, etc., may be anticipated by the Contractor and shall be coordinated with all other trades and indicated on the drawings and descriptive literature called for hereinafter. It shall be the express responsibility of the Contractor to provide all required materials and equipment and perform all work required to install a complete and approved installation.

F. All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and the State Fire Marshal. Also, all work shall comply with the latest editions of the National Board of Fire Underwriters, National Fire Protection Association, OSHA Regulations, the National Building Code, the Life Safety Code, IMC Code and the Southern Building Code (Where applicable). The local insuring agency shall review plans prepared and submitted by the Contractor but shall have no authority to make changes once work has begun.

G. All work performed under this section shall be accomplished in close harmony with all other trades. All work not so coordinated shall be removed and reinstalled at the expense of the Contractor.

H. The Contractor shall submit a proposed layout to the Engineer prior to submittal to the Fire Marshal's Office.

2. SCOPE OF WORK

A. Furnish all material, labor, tools, equipment and supervision required for installation of a complete fire protection and stand pipe system as indicated on the project drawings. Include all necessary piping, sprinkler heads, test connections, valves, drains, cabinets, siamese connections, fire hydrants, fire pump, etc.

B. The Contractor shall provide flushing and sterilization of all water lines in accordance with current Kentucky Plumbing Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water.

C. Provide seismic restraints in accordance with the Seismic Restraint specification section 202600.

3. WATER SUPPLIES AND SYSTEM LAYOUT CRITERIA

A. Where flow and pressure data are available, they are indicated on the project drawings. The Contractor shall independently verify all such information and notify the engineer of any discrepancies discovered prior to beginning the work. Where no flow information is indicted on the project drawings, the Contractor shall obtain it and indicate it on the shop drawing submittal. Piping systems shall be hydraulically sized based on the most conservative flow information obtained. No adjustments in the contract amount will be allowed for failure of the Contractor to obtain adequate flow information.

4. SYSTEM DRAINAGE

A. The entire Sprinkler System (except that part which is below grade and will not freeze) shall be installed so as to allow 100% drainage.

B. All sprinkler branch piping shall be installed so as to drain back to the main riser.

C. Approved 2" drawoff piping shall be provided on sprinkler risers with discharge piping running to nearest floor drain or open air.

D. Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.

E. All draw-offs shall have a metal tag labeled "Sprinkler Drain."

5. INSPECTIONS AND TESTS

A. Furnish all labor, equipment and conduct all required tests in the presence of the Owner and Engineer or designated representative.

B. All piping and devices comprising the fire protection system shall be tested under hydrostatic pressure of not less than 200 PSI and maintained for not less than two (2) hours.

C. Upon completion of his work, the Contractor shall submit a written and signed certificate to the Engineers indicating that he performed the above prescribed tests and rectified all malfunctions arising there from.

6. PERMITS

A. The Contractor shall obtain and pay for all necessary state, municipal, county, city and other permits and fees and pay all State taxes which are applicable.

7. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, for a period of one year after date of final acceptance.

8. ACCEPTANCE CERTIFICATE

A. Upon completion, the Contractor shall submit to the Engineers, a properly filled out "Sprinkler Contractor's Certificate Covering Materials and Tests." (4 copies).

9. CLEANING

A. Upon completion of this work all debris, material, and equipment shall be removed from the building and premises; all piping shall be cleaned ready for finish painting. Note: Do not remove rust inhibitive primer specified hereinafter.

10. PAINTING

A. All fire protection piping, fittings, etc., shall have one factory or shop coat of rust inhibitive primer. The Contractor shall thoroughly clean all such items in areas where the piping will be exposed so as to readily receive the finish coat specified in the Architectural Division of Painting. Colors shall be as specified in Identification Section of these specifications.

11. EQUIPMENT AND MATERIALS

A. Signs

Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire.

B. Finish

All exposed materials such as valves, fire department connections, sprinkler heads, fire pump test headers, etc., shall be brass or chrome-plated brass.

C. Pipe & Fittings

(1) Nipples and fittings shall be of same material, composition, and weight classification as pipe in which installed.

(2) Up to 2" (Interior) Schedule 40 ASTM A-53 black steel; 125# cast iron screwed fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.

(3) 2-1/2" and larger (Interior) Schedule 40 black steel with flanged, welded or victaulic (or similar) type approved fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.

D. Clamps and Anchors

(1) Furnish and install approved clamps, as required, at all (45 degree) l/8 bends, (90 degree) 1/4 bends and flange and spigot pieces to the straight pipe to insure permanent anchorage of all fire lines. Clamps, clamp rods, nuts, washers, and glands shall be coated with a quick drying coal tar bituminous paint after installation.

E. Hangers

(1) All piping shall be adequately and permanently supported in an approved manner on approved hangers (Submit with drawings).

F. Sleeves and Escutcheon Plates

(1) Furnish and install sleeves for pipes where piping penetrates masonry walls; exterior wall sleeves to be watertight. Fire and smoke stop all penetrations through fire and smoke walls and coordinate with General Contractor for locations.

(2) Furnish and install cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings and floors, whether in finished areas or not.

G. Inspection Test Connections & Pressure Gauges

(1) A 1" inspection test connection as required by the Kentucky Building Code. Discharge shall run to open air.

(2) Control valve for test connection shall be installed not over 7' above the floor.

(3) A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be 2-1/2" diameter and readable from the floor.

H. Gate Valves

(1) 2-1/2" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged; cast iron discs; bronze seat rings; four point wedging mechanism; equivalent to Mueller, Scott or Lunkenheimer.

(2) 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.

I. Sprinkler Heads

Gem, Grinnell, Star, Viking, Reliable, Central or approved equivalent as follows:

(1) Where piping is exposed: "Standard up right."

(2) Where piping is concealed above finished ceilings, provide fully concealed sprinkler heads with cover color coordinated with ceiling; refer to architectural plans and details.

(3) Install sprinkler head guards where heads are subject to physical abuse. Heads located below seven (7) feet above floor, etc.

(4) Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices. Indicate degree ratings on submitted Shop Drawings.

(5) The Contractor shall submit to the Engineer for inspection, one (1) sample of each type of sprinkler head, proposed to be used on the project.

(6) Where heads are installed in a tile ceiling, they shall be installed in the middle of the tiles, at half or quarter points along the length of the tiles. Install sprinkler heads at quarter points of center scoured 2' X 4' ceiling tiles.

(7) Provide high temperature heads around range hoods, kitchen equipment, kilns, boilers, water heaters and other heat producing equipment.

12. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, or vandalism, for a period of one year after date of final acceptance.

END OF SECTION 210100

SECTION 220100 - PLUMBING SPECIALTIES

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work specified in this section.

B. The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the Virginia Building Code.

C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

D. Prior to final inspection, test by operation at least twice, all equipment.

E. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.

F. All equipment and specialties shall be installed as recommended by the manufacturer in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.

2. DRAINAGE SPECIALTIES

A. GENERAL

(1) Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors.

(2) Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected.

(3) Drainage specialties shall be installed in a manner so as to ensure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.

B. GREASE INTERCEPTOR (GI-1)

(1) Basis of Design:
    a. Oldcastle GI-1000 (see civil drawings for additional applicable information).
(2) Include inlet/outlet connections with internal influent nozzle, vent connections, manholes, two skimming compartments, non-clogging flow diffusion and energy dissipater baffle, and piping or openings to retain grease and to permit wastewater flow. If distributed pipe configuration is proposed pipe diameter shall be twice the diameter of the inlet pipe and shall direct flow across the entire cross sectional area. Straight pipe is not acceptable.
(3) Structural Design Loads:
    a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
(4) Gravity based grease interceptor shall be constructed of fiberglass reinforced plastics to ASTM specifications and suitable for underground installation and shall be installed per the manufacture's recommendations. Provide interceptor with all cleanouts, sample ports, ventilation ports together with extension collars, frames and covers to allow access for removal of sediment.
(5) Design Characteristics: 24" diameter manway with extension to grade and heavy duty cover labeled "S" for sanitary. Two (2) – 6" diameter threaded connections with dielectric bushings in each fitting. Striker plates are required under each opening. One (1) – 8"x8" vertical tee fitting on discharge outlet with 8" PVC pipe to surface with cast iron frame and cover for effluent sampling port. Provide tie-down straps per the manufacture's recommendations and requirements.
(6) Warranty: 30 years against leakage, corrosion and structural failure.
(7) Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
(8) Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover.
    a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
    c. Include indented top design with lettering cast into cover, using wording equivalent to "GREASE INTERCEPTOR."
(9) Capacities and Characteristics:
    a. Length by Width by Depth: 8'-0" by 5'-2" by 5'-11".
    b. Number of Compartments: Two.
    c. Retention Capacity: 1500 gallon.
    d. Inlet and Outlet Pipe Size: NPS 4.
    e. Trapped Outlet Required: No.
    f. Vent Pipe Size: 2".
    g. Installation Position: Underground with manhole riser to grade.

C. SOLIDS INTERCEPTORS (SI-1)

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company; 61030 Series. (Basis of Design)
2) Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3) Tyler Pipe; Wade Div.
4) Watts Drainage Products Inc.
5) Zurn Plumbing Products Group

(2) Type: Factory-fabricated interceptor made for removing and retaining sediment from wastewater, top access.
(3) Body Material: Cast iron or steel.
(4) Interior Separation Device: Screens.
(5) Interior Lining: Corrosion-resistant enamel.
(6) Exterior Coating: Corrosion-resistant enamel.
(7) Body Dimensions: 7" x 7" x 10"
(8) Flow Rate: Not required.
(9) Inlet and Outlet Size: NPS 2".
(10) End Connections: Threaded.
(11) Mounting: **Above floor; within base cabinet**.

D. ACID NEUTRALIZER (AN-1)

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Orion (Watts). (Basis of Design)
2) Ipex
3) Park

(2) Type: Rectangular bolted top tank.
(3) Body Material: Rotationally molded virgin PE resin conforming to ASTM D1248.
(4) Body Dimensions: 12" x 24" x 12"
(5) Flow Rate: Not required.
(6) Inlet and Outlet Size: 3" with a single FIP inlet with dip tube.
(7) Fill Material: Limestone chips installed per the Manufacturer's recommendations.
(8) Mounting: **Above floor**.

E. CLEANOUTS - INTERIOR (CO/FCO/WCO)

(1) In addition to cleanouts indicated, provide cleanouts in soil and waste piping and condensate drainage at the following minimum locations:

a. At base of each stack.
b. At fifty (50) foot maximum intervals in horizontal lines.
c. At each change of direction of a horizontal line.
d. As required by current VCC.
e. As required to permit rodding of entire system. (If in doubt, contact Engineers.)

(2) Water closets, slop sinks and other fixtures with fixed traps shall not be accepted as cleanouts.

(3) Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.

(4) Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Watts. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's option, be Perma-Coated steel, prepared to receive finish.

(5) Cleanouts and access panels shall be sized so as to permit the entry of a full-sized rodding head capable of one hundred percent circumferential coverage of the line served.

(6) Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.

(7) Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.

(8) In finished walls, floors, etc., ensure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.

(9) Cleanouts shall be as manufactured by Zurn, Josam, Jay R. Smith, Watts, MIFAB, Ancon or equivalent, similar to the following:

a. Zurn, Z-1440 cleanouts or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.

b. Zurn, Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls

c. Zurn, ZN-1400-T cleanout with square scoriated top in finished concrete and masonry tile floors.

d. Zurn, ZN-1400-Tx cleanout with square recessed top for tile in vinyl and linoleum finished floors.

e. Zurn, ZN-1400-Z cleanout with round recessed top for terrazzo floors.

f. Zurn, Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water. Refer to drawings for pad size.

g. Mueller, No. D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.

h. Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.

i. Zurn, cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.

(10) Standard: ASME A112.36.2M

F. FLOOR DRAINS (FD-x/EFD)

(1) Provide floor drains at locations indicated and/or as required by state & local building code. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to ensure floor pitch to drain where required.

(2) Install floor drains in strict accordance with manufacturer's recommendations and the VCC unless otherwise indicated.

(3) Each floor drain located on floors above the lowest floor shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar or chlorinated polyethylene shower pan liner of 30 mil. Lead pans shall be given a heavy coat of asphalt on bottom and sides before installation and a heavy coat on exposed surfaces (if any). After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.

(4) Ensure, by coordination with the appropriate persons or party, that spaces served by a floor drain(s) have a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.

(5) The floor drains shall be Zurn, Josam, Watts,Jay R. Smith, MIFAB, Sioux Chief or equivalent, similar to the following:

a. FD-1 - Zurn, Z-415 with 6" X 6" top, Type "S" strainer. Provide with trap primer connection.

(6) Standard: ASME A112.6.3

G. TRAP PRIMERS

Provide trap primers for all floor drains and open receptacles. Acceptable Trap Primer Manufacturers included Zurn, Precision Plumbing Products and Sioux Chief. Trap Primer selection shall be as follows:

(1) Trap Primer Type-1

Precisions Plumbing Products Prime-Time or equal electronic trap priming manifold, with atmospheric vacuum breaker, pre-set 24-hour clock, manual override switch, 120-volt solenoid valve with 120v/3wire connection. Provide in 12” x 12” x 4” surface mounted metal cabinet.

Provide with 4 opening manifold, un-used manifold opening shall be capped. Install united as required by manufacturer.

(2) Trap Primer Type-2

Precision plumbing products Prime-Rite or equal trap primer shall be installed on a cold water line, with distribution unit(s) to serve 1 to 8 drains. Install per manufacturer's recommendations.

Standard: ASSE 1018

H. CLEANOUTS (EXTERIOR) (ECO)

Provide exterior cleanouts at each location indicated and, in the manner, indicated. Permanently set all exterior cleanouts centered in a 30" X 30" X 6" deep concrete pad. The top of the concrete pad shall be flush with finished grade. The top of the cleanout box shall be flush with the top of the pad and shall be stamped "CO."

Standard: ASME A112.36.2M

I. ROOF DRAINS (RD-x/ORD-x/RDC-x)

(1) Each drain shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar. Roof drains shall be installed in strict accordance with the drain manufacturers and roofing manufacturer's instructions. Provide all accessories required for a complete installation.

(2) Roof Drains - Complete with combination membrane flashing clamp/gravel guard and low silhouette bronze dome. Provide with any accessories for installation in roof specified by the Architect and as recommended by the roofing manufacturer.

(3) Overflow Roof Drains – Complete with external water dam with 2" high combination membrane flashing clamp/gravel guard and low silhouette bronze dome. Provide with any accessories for installation in roof specified by the Architect and as recommended by the roofing manufacturer.

(4) Standard: ASME A112.6.4

J. DOWNSPOUT NOZZLES (DS-x)

Cast nickel bronze with anchor flange with stainless steel bird screen.

K. AIR ADMITTANCE VALVES (AAV-1)
Provide where island venting methods are required.

a. Material: Fire retardant polypropylene conforming to ASTM D-4101

b. Connection: Schedule 40 fusion or mechanical joint fitting
c. Temperature Range: -40°F to 212°F
d. Installation: Install no less than 4” above the horizontal branch drain or fixture drain. All AAVs shall be installed in an accessible location. Contractor shall follow the manufacturer's recommendations and Chapter 9 Section 918 of the Virginia Plumbing Code.

Standard: ASSE 1049 and NSF 14

3. WATER SUPPLY SPECIALTIES

A. GENERAL

(1) Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in a neat and workmanlike manner in accordance with the manufacturer's recommendations and the VCC.

(2) Where required by the VCC, install code approved vacuum breakers in each water supply specialty.

B. FREEZEPROOF WALL HYDRANTS (FPWH)

(1) Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and ensure that the feed piping is on the heated side of the building insulation blanket.

(2) Where hydrants are of handwheel type, remove handwheels and turn over to owners in an envelope labeled "Wall Hydrants" exterior upon completion of the project.

(3) Where hydrants have key operators, turn over at least two (2) keys in an envelope labeled "Wall Hydrants" to owners upon completion of the project.

(4) Where hydrants have lockable boxes, turn over at least two (2) keys in an envelope labeled "Wall Hydrants, Exterior" to owners upon completion of project.

(5) Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineers.

(6) Wall hydrants shall be as follows, as scheduled, or equivalent:

a. Zurn 1300 or equivalent, 3/4", encased, flush, non-freeze wall hydrant with key lock and combination backflow preventer/vacuum breaker.

(7) Standard: ASME A112.21.3M

C. HOSE BIBBS (WH-1)

(1) Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated and as follows:
    a. In group restrooms

(2) Do not install hose bibbs spaces which do not have existing planned or installed floor drains even if sill cocks are indicated for these areas.

(3) Hose bibbs shall be mounted at eighteen (18) inches above finished floor served.

(4) The hose bibb shall be as scheduled or equivalent to the following:

    a. Zurn Z1350-VB Model. Encased moderate climate wall hydrant for narrow wall installation. Complete with bronze body, all bronze interior parts, replaceable seat washer, screwdriver operated stop valve in supply, key operated control valve, and ¾ [19] IP female inlet and ¾[19] male hose connection standard. Adjustable stainless-steel box furnished with hinged cover, cylinder lock and "WATER" stamped on cover. Provide with 3/4 adapter vacuum breaker.

(5) Standard: ASME A112.18.1

D. WATER HAMMER ARRESTORS (WHA): Provide water hammer arrestors at each location indicated and/or as required to eliminate hydrostatic on the domestic water system. Provide at least one water hammer arrestor at all quick acting valve locations including:

Automatic Clothes Washers – Type "A"
Mop Basins (downstream of check valve) – Type "A"
Flush valve fixtures - Type "B" (Each toilet room with 1-3 flush valve fixtures shall have its own Type "B" water hammer arrestor.)

(1) Multiple Fixtures – Branch Line Less Than 20' Long: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures when the branch lines do not exceed 20' in length, from the start of the horizontal branch line to the last fixture supply on this line.

(2) Multiple Fixtures – Branch Line More Than 20' Long: On branch lines over 20' in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

(3) Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade, or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall not be acceptable.

(4) Standard: ASSE 1010

(5) Note: Provide insulation unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).

MARK	MANUFACTURER & MODEL	SIZE	P.D.I. SIZE
TYPE "A"	ZURN, Z-1700 # 100	1-11	A
TYPE "B"	ZURN, Z-1700 # 200	12-32	B
TYPE "C"	ZURN, Z-1700 # 300	33-60	C
TYPE "D"	ZURN, Z-1700 # 400	61-113	D

E. REDUCED PRESSURE BACKFLOW PREVENTERS (RPBP)

As scheduled, or equivalent, reduced pressure backflow preventer. Provide with gate valves for isolation, FDA food grade strainer and air gap fitting. RPBP shall be UL listed.

Standard: ASSE 1013

4. GENERAL SPECIALTIES

A. VACUUM BREAKERS AND BACK FLOW PREVENTERS

Where required by the VCC, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.

(1) Where domestic water system connects to fire protection system.

(2) Where domestic water system connects to hydronic system.

(3) At any hose (threaded) tap on the domestic water system.

B. ROOF FLASHINGS

All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the VCC and as recommended by the roofing manufacturer and/or Contractor.

C. GAS PRESSURE REGULATORS

Provide gas pressure regulators for all gas fired equipment that requires a lower pressure than what is delivered to the appliance. Regulators shall be installed in accordance with the requirements of NFPA 54 and/or International Fuel Gas Code, whichever is more stringent.

END OF SECTION 220100

SECTION 220200 - PLUMBING FIXTURES, FITTINGS AND TRIM

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.

C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

D. All exposed piping or in casework below sinks, stops, traps, tailpieces, etc., shall be code approved chrome plated brass unless otherwise indicated or specified. Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws.

E. All fittings, fixtures and trim shall be new unless otherwise indicated or specified. They shall also be of equivalent quality, dimensions, material, etc. as those specified. All faucets, shower heads, drains, levers, trim, etc. shall be constructed of metal and not plastic.

F. Handicapped fixtures shall be mounted as recommended by the VBC and ADA.

G. All fixtures shall be mounted as recommended by the manufacturer. Fixtures shall be rigidly mounted to walls and floors. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.

H. Prior to final inspection open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained.

I. Prior to final inspection, test by operation at least twice:

(1) (Where applicable) adequate flow of hot and/or cold water at;

a. All Faucets
b. Flush Valves and Tanks
c. Hose Bibbs
d. Sill Cocks
e. All Other Valved Hot and/or Cold Water Openings in the Plumbing System

(2) All toilet seats

(3) All flush tank overflows

J. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.

K. All sink and lavatory traps shall have screw in plugs in the bottom for ease of cleaning and have mechanical fittings for ease of removal.

L. All fixtures shall be set level and true and shall be grouted into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing grout for such service.

M. Special Note for Handicap Grab Rails: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal and service without removal of the grab bar.

N. All exposed drain pipes and domestic water piping under handicap accessible sinks and lavatories shall be insulated in accordance with ADA requirements and shall have a vinyl plastic covering over all insulation.

O. The Contractor shall obtain a copy of the casework shop drawings and confirm sinks, faucets, gas turrets, etc., will fit in the space provided. Additionally, in ADA applications with handicap sink base cabinets, the Contractor shall limit the total distance from the bottom of the sink to the bottom of the P-trap and coordinate waste pipe rough-in height to ensure the proper installation of the handicap sink base cabinet front closure panel. The Contractor shall not order sinks until he confirms no conflicts occur and shall adjust sink sizes if required. If the Contractor orders sinks, faucets, etc., that do not fit in the casework supplied, he shall replace them at no additional cost.

P. All lavatories, sinks, etc. shall be supplied with center rear drain outlets where necessary to avoid conflict with casework, handicapped kneeboards, etc. If the Contractor orders sinks that do not fit in the casework supplied, he shall replace them at no additional cost.

Q. All single supply faucets shall be provided with mechanical mixing valves unless otherwise noted. Mechanical mixing valves shall have hot and cold water inlet connections, common outlet, in-line check valves, and adjustable temperature setting. Mixing valves shall be Moen model 104424 or equal. Provide one mixing valve per single supply faucet unless otherwise noted. Contractor shall provide all required connections and set mixing valve to required temperature.

R. All gooseneck faucets shall have rigid spouts, unless swing spouts are specified. If swing spouts are specified, the spout shall have a maximum swing of 180 degrees from side to side.

S. All plumbing fixtures shall comply with federal lead-free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.

T. All water closet handles on ADA water closets shall be located on the approach side of the fixture.

2. FIXTURES AND TRIM

Available Manufacturers: Subject to compliance with requirements of manufacturers offering plumbing fixtures and trim. Plumbing fixtures and trim, which may be incorporated in the work include, but are not limited to, the following:

A. Plumbing Fixtures - Water Closet, Lavatory, and Urinal

American Standard shall be an owner preferred manufacturer. **Acceptable equivalent manufacturers include**:

Eljer Plumbingware Div., Wallace-Murray Corp.
Kohler Co.
Crane Plumbing
Universal-Rundle
Toto
Zurn Co.
Sloan Fixtures

B. Plumbing Trim

Delta Faucet shall be an owner preferred manufacturer. **Acceptable equivalent manufacturers include:**

American Standard, U.S. Plumbing Products
Chicago Faucet Co.
Kohler Co.
T&S Brass & Bronze Work Co. (Commercial)
Zurn Co.
Just Co.
Speakman Co.
Moen Commercial

C. Flush Valves

Delany Co.
Sloan Valve Co.
Zurn Co.
American Standard

D. Fixture Seats

Bemis Mfg. Co.
Church Seat Co.
Olsonite Corp., Olsonite Seats

E. Water Coolers

Elkay Mfg. Co.
Halsey Taylor Div., King-Sealey Thermos Co.
Haws Drinking Faucet Co.
Western Drinking Fountains, Div. of Sunroc Corp.
Oasis Co.
Acorn AQUA

F. Service Sinks and Mop Basins

American Standard, U.S. Plumbing Products
Eljer Plumbingware Div., Wallace-Murray Corp.
Fiat Products
Kohler Co.
Stern-Williams Co., Inc.
Florestone

G. Stainless Steel Sink

Elkay Mfg. Co.
Just Mfg. Co.
Moen, Div. of Stanadyne/Western
Sterling Co.

H. Fixture Carriers

Josam Mfg. Co.
Jay R. Smith
Tyler Pipe
Zurn Industries
Watts

I. Washer/Dryer Connection Box

Guy Gray Co.
Wolverine Brass, Inc.

J. P-Trap Insulation Kit (Trap Wrap)

Truebro
Brocar
Plumberex

3. FIXTURE SELECTION

A. Refer to drawings for fixture schedule.

4. STANDARDS TO BE COMPLIED WITH (WHEN APPLICABLE):

(1) Comply with the following applicable standards and other requirements specified for plumbing fixtures:

a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.

b. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.

c. Stainless-Steel Residential Sinks: ASME A112.19.3.

d. Vitreous-China Fixtures: ASME A112.19.2M.

(2) Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

a. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

b. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.

c. Diverter Valves for Faucets with Hose Spray: ASSE 1025.

d. Faucets: ASME A112.18.1.

e. Hose-Connection Vacuum Breakers: ASSE 1011.

f. Hose-Coupling Threads: ASME B1.20.7.

g. Integral, Atmospheric Vacuum Breakers: ASSE 1001.

h. NSF Potable-Water Materials: NSF 61.

i. Pipe Threads: ASME B1.20.1.

j. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

k. Supply Fittings: ASME A112.18.1.

l. Brass Waste Fittings: ASME A112.18.2.

(3) Comply with the following applicable standards and other requirements specified for shower faucets:

a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.

b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.

c. Faucets: ASME A112.18.1.

d. Hand-Held Showers: ASSE 1014.

e. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.

f. Hose-Coupling Threads: ASME B1.20.7.

g. Manual-Control Antiscald Faucets: ASTM F 444.

h. Pipe Threads: ASME B1.20.1.

i. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

j. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

(4) Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

a. Atmospheric Vacuum Breakers: ASSE 1001.

b. Brass and Copper Supplies: ASME A112.18.1.

c. Dishwasher Air-Gap Fittings: ASSE 1021.

d. Brass Waste Fittings: ASME A112.18.2.

e. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

(5) Comply with the following applicable standards and other requirements specified for miscellaneous components:

a. Disposers: ASSE 1008 and UL 430.

b. Flexible Water Connectors: ASME A112.18.6.

c. Floor Drains: ASME A112.6.3.

d. Grab Bars: ASTM F 446.

e. Hose-Coupling Threads: ASME B1.20.7.

f. Off-Floor Fixture Supports: ASME A112.6.1M.

g. Pipe Threads: ASME B1.20.1.

h. Plastic Toilet Seats: ANSI Z124.5.

i. Supply and Drain Protective Shielding Guards: ICC A117.1.

END OF SECTION 220200

SECTION 220300 - PLUMBING EQUIPMENT

1. GENERAL

A. All plumbing equipment shall comply with the latest provisions of Virginia Construction Code.

2. WATER HEATER(S) – (WH-1 & WH-2)

a. SUMMARY

1) Section Includes:

(a) Commercial, electric, storage, domestic-water heaters.
(b) Commercial, light-duty, storage, electric, domestic-water heaters.
(c) Domestic-water heater accessories.

b. PERFORMANCE REQUIREMENTS

1) Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

(a) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

c. ACTION SUBMITTALS

1) Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2) LEED Submittals:

(a) Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

3) Shop Drawings:

(a) Wiring Diagrams: For power, signal, and control wiring.

d. INFORMATIONAL SUBMITTALS

1) Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

(a) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
(b) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
(c) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2) Product Certificates: For each type of commercial, electric, domestic-water heater, from manufacturer.

3) Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

4) Source quality-control reports.

5) Field quality-control reports.

6) Warranty: Sample of special warranty.

e. CLOSEOUT SUBMITTALS

1) Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

f. QUALITY ASSURANCE

1) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2) ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

3) ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

4) NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

g. COORDINATION

1) Coordinate sizes and locations of concrete bases with actual equipment provided.

h. WARRANTY

1) Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

(a) Failures include, but are not limited to, the following:

i. Structural failures including storage tank and supports.
ii. Faulty operation of controls.
iii. Deterioration of metals, metal finishes, and other materials beyond normal use.

(b) Warranty Periods: From date of Substantial Completion.

i. Commercial, Electric, Storage, Domestic-Water Heaters:

a) Storage Tank: Five years.
b) Controls and Other Components: Three years.

ii. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

a) Storage Tank: Five years.
b) Controls and Other Components: Three years.

B. PRODUCTS

a. COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

1) Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

(a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

i. Bradford White Corporation.
ii. Hubbell.
iii. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
iv. State Industries.

(b) Standard: UL 174.
(c) Storage-Tank Construction: Steel, vertical arrangement.

i. Tappings: ASME B1.20.1 pipe thread.
ii. Pressure Rating: 150 psig.
iii. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

(d) Factory-Installed Storage-Tank Appurtenances:

i. Anode Rod: Replaceable magnesium.
ii. Dip Tube: Required unless cold-water inlet is near bottom of tank.
iii. Drain Valve: ASSE 1005.
iv. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
v. Jacket: Steel with enameled finish.
vi. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
vii. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
viii. Temperature Control: Adjustable thermostat.
ix. Safety Control: High-temperature-limit cutoff device or system.
x. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

(e) Special Requirements: NSF 5 construction with legs for off-floor installation.

2) Capacity and Characteristics:

(a) Refer to schedule on drawings.

b. DOMESTIC-WATER HEATER ACCESSORIES

1) Domestic-Water Compression Tanks:

(a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

i. AMTROL Inc.
ii. Flexcon Industries.
iii. Pentair Pump Group (The); Myers.
iv. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
v. State Industries.
vi. Taco, Inc.

(b) Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

(c) Construction:

i. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
ii. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
iii. Air-Charging Valve: Factory installed.

(d) Capacity and Characteristics:

i. Working-Pressure Rating: 100 psig.
ii. Capacity Acceptable: 2 gal. minimum.
iii. Air Precharge Pressure: 60 psi.

2) Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

3) Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

4) Heat-Trap Fittings: ASHRAE 90.2.

5) Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and memory-stop balancing valves to provide balanced flow through each domestic-water heater.

(a) Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
(b) Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

6) Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.

7) Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

8) Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

9) Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

10) Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

11) Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

12) Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

c. SOURCE QUALITY CONTROL

1) Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

2) Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

3) Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

4) Prepare test and inspection reports.

C. EXECUTION

a. DOMESTIC-WATER HEATER INSTALLATION

1) Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

(a) Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

2) Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

3) Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

4) Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

5) Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-

Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

6) Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

7) Fill electric, domestic-water heaters with water.

8) Charge domestic-water compression tanks with air.

b. CONNECTIONS

1) Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

2) Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

c. IDENTIFICATION

1) Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

d. FIELD QUALITY CONTROL

1) Perform tests and inspections.

(a) Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
(b) Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
(c) Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
(d) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

2) Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

3) Prepare test and inspection reports.

e. DEMONSTRATION

1) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

3. RECIRCULATING DOMESTIC HOT WATER PUMPS

A. Thrush, Armstrong, Bell and Gossett or approved equivalent all bronze in-line centrifugal circulating pump with mechanical seals, drip proof motor and all required overloads, starters and disconnects.
B. Recirculating domestic hot water pumps shall operate based on occupancy schedule in accordance to the Virginia Energy Conservation Code Chapter 4 Section C404. Provide with Autohot DC000A or similar.

END OF SECTION 220300

SECTION 220800 - COMMISSIONING PLUMBING EQUIPMENT

1. GENERAL

A. RELATED WORK

1. Division 23 – HVAC

2. Division 26 - Electrical

B. REFERENCES

1. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions and Division-1 Specification sections, apply to work of this section.

2. ASHRAE Guideline 1-1996

3. ASHRAE Guideline 0-2005

4. ACG Commissioning Guideline – 2005

B. DESCRIPTION OF WORK

1. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

2. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

3. Assemble and submit a Project Manual detailing installed systems, maintenance schedules, contractor contact information, a system verbal description, system diagrams, the TAB report, lighting startup reports, electrical commissioning report for including in the Project Manual.

2. PRODUCTS

A. Not used.

3. EXECUTION

A. ROLES OF THE COMMISSIONING AGENCY

1. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of Plumbing systems within the facility.

2. The CA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

3. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

4. The CA shall observe and coordinate testing as required to assure system performance meets the design intent.

5. The CA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.

6. The CA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.

7. The CA is to remain an independent party with specific knowledge of the project. The CA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CA shall monitor resolution for conformance with design intent and prevailing industry standards.

8. The CA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for Plumbing systems and subsystems.

9. The CA will review operating and maintenance materials for Plumbing systems.

10. The CA will review phasing plans as provided by the CM relating to temporary use of Plumbing equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

B. SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

1. Domestic Hot Water
2. Domestic Hot Water Recirculating System
3. Domestic Hot Water Heater
4. Automatic Flush Values

C. PLUMBING COMMISSIONING PLAN

1. Commissioning Team

a. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:

Program Manager (PrM)
Facilities Management Division (FMD)
Commissioning Agent (CA)
Design Team (DT)
Construction Manager (CM)
Mechanical Contractor (MC)
Plumbing Contractor (PC)
Controls Contractor (CC)
Test and Balance Contractor (TABC)
Electrical Contractor (EC)

2. Basis of Design Document

a. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.

b. The CA will review the BOD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

3. Commissioning Meetings

a. Commissioning meetings will be held in conjunction with progress meetings as necessary. The CA will be on site for the CX meetings. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

4. Resolution Tracking Forms (RTF)

a. The use of Resolution Tracking Forms is a method employed by the CA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
b. The CA will regularly submit RTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

5. System Verification Checklists (SVC) / Manufacturers' Checklists

a. The MC/PC shall provide SVC's based on the manufacturers start-up procedures. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS*. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
b. The CA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CA.
c. The equipment manufacturers' checklists must also be reviewed by the CA prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CA before start-up can commence.

6. Start-Up

a. Start-up of major Plumbing systems will be witnessed the CA. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting Plumbing equipment.

b. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BoD.

7. Functional Performance Tests (FPT)
   a. The CA will write FPT's based on the BoD. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS* above.
   b. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CA and the owner's maintenance staff. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation.
   c. The Functional Performance Tests shall include Plumbing and related equipment.

      1. Hot water system will be tested.
      2. Heat Exchangers will be tested under relevant operating conditions.
      3. DDC control systems will be tested as necessary.

   d. Deferred Testing

      1. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.
      2. Off-season mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications.

   e. Rescheduled Functional Performance Test

      1. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, contractor shall reimburse the owner for all additional cost the owner incurs as a result of the contractor's failure to be complete and/or to provide operating compliant systems for commissioning. Additional costs include but are not limited to additional fees charged by the architect, engineer, construction manager and commissioning agent.
      2. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed for the commissioning personnel's return trip.

8. Building Turn-Over / Owner Orientation / User Training
    a. The CA will assist contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
    b. The CA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.
    c. Owner training will be coordinated with the assistance of the CA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CA will visit the site during the Turn-Over and Training period to assure that any on-going Plumbing related problems are being addressed and corrected in a timely and efficient manner.
    d. The CA will assist the owner/user with warranty issues.
    e. The CA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

D. RESPONSIBILITIES OF TEAM MEMBERS

1. Construction Manager (CM)

    A. Include commissioning requirements in the mechanical, electrical, and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the Plumbing commissioning process.
    B. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
    C. Assure that the CA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
    D. Coordinate inclusion of commissioning activities in the construction schedule.
    E. Facilitate resolution of deficiencies identified by observation or performance testing.
    F. Assist the CA in monitoring the duct leakage testing.

2. Plumbing Contractor (PC)

    A. Include cost for commissioning requirements in the contract price.
    B. Attend commissioning meetings scheduled by the CA.
    C. Verify proper installation and performance of all plumbing services provided.
    D. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of equipment.
    E. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
    F. Provide an electrical system technician to assist during verification and performance testing.

G. Participate in the Functional Performance Tests as required to achieve design intent.
H. Participate in the off-season mode testing as required to achieve design intent.
I. Participate in O&M Training as required by project specifications.

END OF SECTION 220800

SECTION 230130- HVAC DUCT SYSTEM CLEANING

1. GENERAL

A. SCOPE OF WORK

(1) This Section includes the requirement for cleaning of the existing supply air conveyance systems as noted on the Drawings and described below.

ALL existing duct systems within the project boundary scope areas shall be included in the duct cleaning scope.

B. RELATED WORK SPECIFIED ELSEWHERE

(1) Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to this Section. The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the existing HVAC system supply air ductwork in accordance with these specifications.

C. SUBMITTALS

(1) After carefully reviewing the site and requirements, submit a complete work action outline similar to item A. Scope of Work above for review by the Engineer.

D. QUALITY ASSURANCE

(1) Contractor Qualifications: Contractor must be a certified member of the National Air Duct Cleaners Association (NADCA), and the Indoor Air Quality Association (IAQA).

E. COORDINATION

(1) Perform cleaning at appropriate time in project as to not interfere with other trades or the progress of the work, or existing occupants working in the building.

F. APPLICABLE STANDARDS

(1) National Air Duct Cleaners Association (NADCA) "ACR-2006, Assessment, Cleaning and Restoration of HVAC Systems, ", 2001.

(2) National Air Duct Cleaners Association (NADCA), "Understanding Microbial, Contamination in HVAC Systems,", 1996.

(3) National Air Duct Cleaners Association (NADCA), "Introduction to HVAC System Cleaning services," 2002.

(4) National Air Duct Cleaners Association (NADCA) Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems, "1997.

(5) Underwriters Laboratories (UL), UL Standard 181.

(6) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 62, Ventilation for Acceptable Indoor Air Quality.

(7) Environmental Protection Agency (EPA), "Building Air Quality, "December 1991.

(8) Sheet Metal and Air Conditioning Contractor's National Association (SMANCA):' HVAC Duct Construction Standards — Metal and Flexible," 1985.

2. EXECUTION

A. EXAMINATION

(1) Prior to the commencement of any cleaning work, the cleaning Contractor shall perform a visual inspection of the system to be cleaned to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. Provide video and/or photo report of before and after conditions at multiple areas.

(2) Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

B. GENERAL CLEANING REQUIREMENTS

(1) Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

(2) Particulate Collection: where the particulate collection equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the particulate collection equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with particulate collection equipment in place, including adequate filtration to contain debris removed from the HVAC system. When the particulate collection equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into any building.

(3) Controlling Odors: Measures shall be employed to control odors and/or mists vapors during the cleaning process.

(4) Component Cleaning: Cleaning methods shall be employed such that all components

must be visibly clean as defined per NADCA applicable standards. Upon completion, all components shall be returned to those settings recorded just prior to cleaning operations.

(5) Air-Volume Control devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked beforehand so that they can be returned to their pre-cleaning position.

(6) Service Openings: The Contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical mechanical entry, and inspection.

a. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.

b. Additional openings shall be created by the Contractor as outlined on the Drawings to assist in plenum cleaning.

c. The Contractor shall remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

C. SANITIZING AND CLEANING

(1) Antimicrobial Agents and Coatings:

a. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.

b. Antimicrobial treatments and coatings shall be applied after the system is rendered clean.

c. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.

d. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.

D. HEALTH AND SAFETY

(1) Safety Standards: Cleaning Contractor shall comply with applicable federal, state, and local requirements for protecting the safety of the Contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administrations (OSHA) shall be followed when working in accordance with this specification.

(2) Occupant Safety: No processes of materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

END OF SECTION 230130

SECTION 230300 - CONDENSATE DRAINAGE SYSTEM (FOR COOLING EQUIPMENT)

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this section of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

   B. The Contractor shall provide a complete condensate drainage system to carry all condensate discharge from all cooling equipment from the building. Condensate system shall be installed in accordance with IMC. Provide condensate overflow switch for all condensate producing equipment.

   C. Pipe installation and fabrication shall be in accordance with the section of these specifications entitled PIPE, PIPE FITTINGS AND PIPE SUPPORT and as hereinafter specified.

   D. All piping shall be installed concealed, unless specifically noted otherwise and shall be installed under slabs or underground only when specifically indicated.

   E. Lines installed in ceiling spaces shall be held at the maximum possible elevation and shall be coordinated with all other trades to avoid conflicts.

   F. Condensate drain lines shall be pitched 1/4 inch per foot and installed with cleanout plugs at each change in direction and/or at thirty (30) foot intervals. Where this minimum pitch cannot be attained, contact Engineers.

   G. Horizontal runs of condensate drain lines shall be supported at six (6) foot intervals maximum, or more frequently where required to prevent sags and low spots.

   H. Lengths of horizontal lines shall be held at a minimum due to potential lint collection.

   I. Provide condensate traps in accordance with the manufacturer’s recommendations.

2. MATERIAL

   A. Refer to Section of these Specifications entitled: PIPE, PIPE FITTINGS AND SUPPORT.

3. INSULATION

   A. Refer to Section of these Specifications entitled: INSULATION - MECHANICAL.

END OF SECTION 230300

SECTION 230800 - COMMISSIONING OF MECHANICAL SYSTEMS

1. GENERAL

A. RELATED WORK

1. Division 22 – Plumbing

2. Division 26 - Electrical

B. REFERENCES

1. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions, and Division-1 Specification sections, apply to work of this section.

2. ASHRAE Guideline 1-1996

3. ASHRAE Guideline 0-2005

4. ACG Commissioning Guideline – 2005

B. DESCRIPTION OF WORK

1. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers, and equipment suppliers.

2. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

3. Assemble and submit a Project Manual detailing installed systems, maintenance schedules, contractor contact information, a system verbal description, system diagrams, the TAB report, lighting startup reports, electrical commissioning report for including in the Project Manual.

2. PRODUCTS

A. Not used.

3. EXECUTION

A. ROLES OF THE COMMISSIONING AGENCY

1. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of HVAC systems within the facility.

2. The CA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

3. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

4. The CA shall observe and coordinate testing as required to assure system performance meets the design intent.

5. The CA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.

6. The CA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.

7. The CA is to remain an independent party with specific knowledge of the project. The CA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CA shall monitor resolution for conformance with design intent and prevailing industry standards.

8. The CA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for HVAC systems and subsystems.

9. The CA will review operating and maintenance materials for HVAC systems.

10. The CA will review phasing plans as provided by the CM relating to temporary use of

HVAC equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

B. SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

1. Water to Water Heat Pump
2. Dedicated Outdoor Air Units
3. Geothermal Heat Pumps
4. Exhaust Fans
5. DDC Control System
6. VAV Terminal Units
7. Chilled Heating Water Pumps
8. Domestic Water Heater Heat Pump
9. Geothermal and Building Loop Base Mounted Pumps

C. HVAC COMMISSIONING PLAN

1. Commissioning Team

a. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:

Program Manager (PrM)
Facilities Management Division (FMD)
Commissioning Agent (CA)
Design Team (DT)
Construction Manager (CM)
Mechanical Contractor (MC)
Controls Contractor (CC)
Test and Balance Contractor (TABC)
Electrical Contractor (EC)

2. Basis of Design Document

a. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.

b. The CA will review the BOD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

3. Commissioning Meetings

a. Commissioning meetings will be held in conjunction with progress meetings as necessary. The CA will be on site for the CX meetings. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users, and owners.

4. Resolution Tracking Forms (RTF)

a. The use of Resolution Tracking Forms is a method employed by the CA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
b. The CA will regularly submit RTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

5. System Verification Checklists (SVC) / Manufacturers' Checklists

a. The MC/PC shall provide SVC's based on the manufacturers start-up procedures. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS*. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
b. The CA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CA.
c. The equipment manufacturers' checklists must also be reviewed by the CA prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CA before start-up can commence.

6. Start-Up

a. Start-up of major HVAC systems will be witnessed the CA. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting HVAC equipment.

b. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment online and expedite acceptable functional performance in accordance with the BoD.

7. Controls Monitoring

   a. Close monitoring of the Control Contractor's progress will promote efficient coordination of the TAB work. The CC will be expected to submit point-to-point checklists verifying that his work has been completed and all systems are ready for TAB work and Functional Performance Testing. Programming and graphics will be surveyed by the CA for completeness and conformance with the BoD and the owner's scheduling requirements.

8. TAB Monitoring

   a. The preliminary TAB report set-up will be reviewed prior to HVAC equipment start-up, to assure that the final TAB report format and content is acceptable.
   b. TAB work will be monitored so that any problems that prevent or hinder proper air and water balance can be addressed and corrected with minimal delays. By addressing these problems as quickly as possible, we can assure that functional performance testing and owner training will take place on schedule.
   c. A pencil copy of the TAB report will be reviewed prior to submission of the final TAB report. A written review will be submitted to the TAB contractor and to the DT for their comments. A TAB report approved by the DT will be required before Functional Performance Testing can be carried out. The CA will visit the site during the TAB process to assist TABC and CC in the effective completion of their scope of work.

9. Functional Performance Tests (FPT)

   a. The CA will write FPT's based on the BoD. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS* above.
   b. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CA and the owner's maintenance staff. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation.
   c. The Functional Performance Tests shall include HVAC and related equipment.

      1. AHU's will be tested in designed operating modes. Proper operation will be verified at minimum OA, maximum OA, automatic control, and other modes, if necessary, to achieve BOD conformance.
      2. Variable Air Volume terminals with and without reheats will be tested at minimum and maximum temperature set points, and under automatic control. Intermediate settings will be tested as necessary.

3. Chilled water system will be tested in designed operating modes. Proper operation will be verified at minimum loads, maximum loads, waterside economizing mode, Manual control, automatic control, and other modes.
4. Hot water system will be tested.
5. EF's will be tested for conformance to BoD.
6. Hydronic pumps will be tested under relevant operating conditions.
7. Heat Exchangers will be tested under relevant operating conditions.
8. DDC control systems will be tested as necessary.
9. HVAC systems will be tested to assure that the building as an integrated system operates properly.
10. Trend verification of systems and subsystems shall be completed prior to start of functional performance testing. CA will provide trend format to CC and discuss trend requirements in CX meetings throughout the construction phase of project.

d. Deferred Testing

1. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.
2. Off-season mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications. This will be required for all equipment being tested such as heat pumps that cannot be tested in cooling mode if commissioning of the equipment is completed in the winter months.

e. Rescheduled Functional Performance Test

1. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, contractor shall reimburse the owner for all additional cost the owner incurs as a result of the contractor's failure to be complete and/or to provide operating compliant systems for commissioning. Additional costs include but are not limited to additional fees charged by the architect, engineer, construction manager and commissioning agent.
2. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed for the commissioning personnel's return trip.

10. Building Turn-Over / Owner Orientation / User Training
    a. The CA will assist contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
    b. The CA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.

c. Owner training will be coordinated with the assistance of the CA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CA will visit the site during the Turn-Over and Training period to assure that any on-going HVAC related problems are being addressed and corrected in a timely and efficient manner.
d. The CA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

D. RESPONSIBILITIES OF TEAM MEMBERS

1. Construction Manager (CM)

A. Include commissioning requirements in the mechanical, electrical, and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the HVAC commissioning process.
B. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
C. Assure that the CA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
D. Coordinate inclusion of commissioning activities in the construction schedule.
E. Facilitate resolution of deficiencies identified by observation or performance testing.
F. Involve CA in selection of the air balancing contractor.
G. Assist the CA in monitoring the duct leakage testing.

2. Mechanical Contractor (MC)

A. Each contractor in this division shall include in their quote the cost of participating in the commissioning process.
B. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.
C. Assure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, water treatment, temperature controls, and TAB in commissioning activities.
D. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.
E. Attend commissioning meetings scheduled by the CA.
F. Assist the CA in system verification and performance testing.
G. Prepare preliminary schedule for HVAC system inspections, O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-

up, system verification, performance testing, and system completion for use by the CA. Update schedule as appropriate throughout the construction period.

H. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of HVAC equipment.
I. Monitor and respond to Resolution Tracking Forms distributed by the CA to expedite corrective actions necessary to achieve design intent.
J. Notify the CA a minimum of two weeks in advance of scheduled system start-up.
K. Update drawings to as-built condition and review with the CA throughout the construction process.
L. Schedule vendor and subcontractor provided training sessions as required by project specifications.
M. Provide written notification that the following work has been completed in accordance with the project specifications, and that the equipment, systems, and sub-systems are operating in accordance with design intent.

    1. HVAC equipment including fans, air handling units, dehumidification units, ductwork, dampers, terminal devices, etc.
    2. Fire detection and smoke detection devices furnished under other divisions as they affect the operation of the HVAC systems.
    3. That BAS is functioning in accordance with design intent.

N. Participate in the Functional Performance Tests.
O. Participate in the off-season mode testing.
P. Participate in O&M Training as required by project specifications.
Q. Provide a complete set of as-built drawings and O & M manuals for review. The CA shall review the as-built drawings and O&M manuals concurrently with the design team.

3. Test and Balance Contractor (TABC)

A. Include cost for commissioning requirements (participation) in the contract price.
B. Attend commissioning meetings scheduled by the CA.
C. Submit the TAB procedures and preliminary TAB report to the CA for review at least two weeks prior to beginning TAB work.
D. Notify the CA a minimum of two weeks in advance of scheduled TAB work.
E. Provide partial, preliminary TAB Reports by phase, by building section, by system, or as required by the CA.
F. Assist the CA in system verification and performance testing.
G. Monitor and respond to Resolution Tracking Forms distributed by the CA to expedite corrective actions necessary to achieve design intent.
H. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the CA for verification or diagnostic purposes.
I. Participate in the Functional Performance Tests as required to achieve design intent.

J. Provide sound and vibration where required to assist in diagnosis of areas exhibiting unacceptable levels of noise or vibration.
K. Participate in the off-season mode testing as required to achieve design intent.
L. Participate in O&M Training as required by project specifications.

4. Temperature Control Contractor (TCC)
   A. Include cost for commissioning requirements in the contract price.
   B. Review control sequence and component selection for conformance with design intent.

      1. Attend a submittal review meeting with the CA and Engineer to ensure clear understanding of scope of work and expectations.
      2. Verify that specified safeties and interlocks have been selected.
      3. Verify proper selection of control valves and actuators based on design parameters.
      4. Verify proper selection of control dampers and actuators based on design parameters.
      5. Verify that sensor selection conforms to design intent.

   C. Attend commissioning meetings scheduled by the CA.
   D. Provide the following submittals to the CA:

      1. Hardware and software submittals.
      2. Control panel construction shop drawings.
      3. Narrative description of control sequences for each HVAC system and subsystem.
      4. Schematics showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access.
      5. A list of all control points, including analog inputs, analog outputs, digital inputs and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
      6. A complete listing of all software routines employed in operating the control system. Also provide a program narrative that describes the logic flow of the software and the functions of each routine and sub-routine. The narrative should also explain individual math or logic operations that are not clear from reading the software listing.
      7. Hardware operation and maintenance manuals.
      8. Application software and project applications code manuals.
      9. Panel and equipment insert documents.
      10. Assist CA with remote monitoring capabilities. Supply any software and/or hardware needed.

   E. Verify that specified interfaces provided by others are compatible with BAS hardware and software.
   F. Coordinate installation and programming of BAS with construction and commissioning schedules.

G. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of HVAC equipment.
H. Provide control system technician to assist during equipment startup.
I. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
J. Participate in the Functional Performance Tests as required by the project specifications.
K. Provide a control system technician to assist during verification and performance testing.
L. Provide system modifications to achieve system operation as defined by the design intent.
M. Provide support and coordination for TAB contractor. Provide all devices, such as portable operator terminals and all software for the TAB to use in completing TAB procedures.
N. Provide written notification that the TCC scope of work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent, and that BAS is functioning in accordance with design intent.
O. Participate in the Functional Performance Tests as required to achieve design intent.
P. Participate in the off-season mode testing as required to achieve design intent.
Q. Participate in O&M Training as required by project specifications. Include training on hardware operations and programming

END OF SECTION 230800

SECTION 231100 - REGISTERS, GRILLES, DIFFUSERS & LOUVERS

1. REGISTERS, GRILLES AND DIFFUSERS

   A. GENERAL

      Alternate R, G & D selections, other than manufacturers and models listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Price,Titus, Metalaire, Carnes, Anemostat, Krueger, and Tuttle & Bailey. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect. If Architect elects not to select color, all colors shall be off-white. Factory color samples shall be submitted with shop drawings.

   B. SELECTION

      Refer to the Selections Scheduled on the Drawings.

2. LOUVERS

   A. GENERAL

      Alternate louver selections, other than manufacturer and model listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Greenheck, Ruskin, Air Balance, Airline, Airstream, Louvers and Dampers and Penn. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes and color(s) shall be selected by the Architect unless scheduled otherwise.

   B. LINTELS

      Provide lintels above all louvers as required. Refer to the lintel schedule in Specification Section 201100.

   C. SELECTION

      Refer to the Selections Scheduled on the Drawings.

3. GRAVITY INTAKE & RELIEF HOODS

   A. GENERAL

      Alternate selections, other than manufacturer and model listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Greenheck, Ruskin, Air Balance, Airline, Airstream, Louvers and Dampers and Penn. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes and color(s) shall be selected by the Architect unless scheduled otherwise.

B. SELECTION

Refer to the Selections Scheduled on the Drawings.

END OF SECTION 231100

SECTION 231200 - SHEET METAL AND FLEXIBLE DUCT

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's HVAC Duct Construction Standards, Metal and Flexible, and its subsequent addenda. HVAC duct systems shall be fabricated and installed in accordance with the SMACNA duct construction standards (SMACNA-HVAC and SMACNA-Seismic) including Appendix B of the Seismic Restraint Manual Guidelines for Mechanical Systems. These references and plate numbers shall be used by the Engineer for required sheet metal thicknesses and final acceptance of methods of fabrication, hanging, accessories, etc. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.

C. Ductwork shall be constructed and installed per the latest edition of the International Mechanical Code.

D. Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic to prohibit dust and dirt from entering the installed ductwork, air handling unit, terminal devices, etc. Provide temporary filters on all return grilles and duct openings if the units are running prior to the building being satisfactorily cleaned. Do not install the ductwork if the building is not "dried-in". If this is required, the open ends of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.

E. Provide a SMACNA duct cleanliness level "C" per the latest SMACNA standards. [Refer to LEED / Healthcare Requirements]

F. If separate filter grilles are specified for an HVAC unit the Contractors shall remove any unit mounted filters and blank off the unused filter access opening with sheet metal and seal air tight.

G. Wall Penetrations: Where ducts penetrate interior or exterior walls, the walls shall be sealed air tight. Refer to the sleeving, cutting, patching, and repairing section of the specifications for additional requirements.

H. Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

I. Prior to purchase/shipment of the ductwork, manufacturer shall provide as part of the submittal process scaled, field coordinated AutoCAD drawings of the complete system to be furnished. Drawings will indicate all system components including fittings, ductwork and manifolds. Drawings shall be available in an electronic format.

2. LOW PRESSURE DUCTWORK

A. General (Low Pressure)

(1) Double turning vanes shall be installed in all square turns and in any other locations indicated.

(2) Provide a “high efficiency” type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.

(3) Cross-break all ducts where any duct section dimension or length is 18" or larger.

(4) Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.

(5) Splitter dampers shall be provided in all rectangular supply air duct tees. Damper blade operator shall extend a minimum two inches thru the insulation.

(6) Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.

(7) Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. Duct supports shall not exceed 12 ft intervals. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from purlins or other weak structural members where no additional weight may be applied. If in doubt, consult the structural engineer.

(8) Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.

(9) All ductwork connections, fittings, joints, etc., including longitudinal and transverse joints, seams and connections shall be sealed. Seal with medium pressure, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, nonflammable, and rated to 15" wg. Apply per manufacturer's recommendations. Contractors shall ensure no exposed sharp edges or burrs on ductwork.

(10) All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

(11) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, coils, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

(12) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.

(13) The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.

(14) All fans and other vibrating equipment shall be suspended by independent vibration isolators.

(15) The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.

B. Materials (Low Pressure Single Wall)

(1) Ductwork, plenums and other appurtenances shall be constructed of the following:

a. Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating or aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14. Utilize Aluminum in MRI Scan Rooms or NMR Room applications.

b. Exposed ductwork in finished spaces requiring insulation such as gymnasiums, etc., shall be dual wall ductwork.

(2) Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard or the below table, whichever is more stringent. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum:

ROUND DUCT		RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 12	26	UP TO 12	26
12 TO 18	24	13 TO 30	24
19 TO 28	22	31 TO 54	22
29 TO 36	20	55 TO 84	20
37 TO 52	18	85 AND ABOVE	18

C. Materials (Low Pressure Double Wall Ductwork)

(1) Install Double Wall Ductwork in the following areas:

a. Gymnasium(s)
b. Auditorium(s)
c. Lobbies (where exposed)
d. Above areas with partial ceilings or clouds.
e. Anywhere supply ductwork is installed exposed to view in spaces (other than mechanical rooms)
f. At all other locations indicated on drawings.

(2) Furnish and install where indicated double wall duct. The double wall duct shall be Eastern Sheet Metal, United McGill, Semco or approved equivalent. The duct shall have an inner shell, a 1-inch layer of fiberglass insulation and an outer pressure shell.

(3) Ductwork outer shell shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Any ductwork exposed to view shall be constructed of G90 galvanized steel, 20 gauge, and shall be supported as required with aircraft cables and self-tightening locks. Ductwork shall be constructed as specified in LOW PRESSURE DUCTWORK.

(4) Inner shell for spiral pipe shall be a perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23%.

(5) Inner shell for fittings shall be galvanized steel. All fittings shall be manufactured by the same manufacturer as the spiral pipe. Fittings shall be constructed a minimum of 22 Ga.

(6) The fiberglass liner shall have a maximum thermal conductivity (k) factor of 0.27 btu per hour per square foot per degree Fahrenheit per inch thickness at 75-degree F ambient temperature.

(7) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner

couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.

(8) All grille and register taps shall be factory manifolded. Field installed taps will not be allowed. Manifolded taps may be tack welded and caulked for appearance. Only taps for grilles and registers may be provided this way. All other fittings shall be full body welded.

D. Miscellaneous (Low Pressure)

(1) Un-insulated Flexible ductwork (Use Only Where Indicated)

a. Un-insulated flexible ductwork shall be corrugated aluminum. No sections shall be greater than five feet in length. Ductwork shall be UL rated and in accordance with IMC.

b. Flexible ductwork installed in a return or exhaust or other negative static pressure application shall be rated for installation in negative pressure systems.

c. Provide Titus "FlexRight" or equal flexible duct bracing at each diffuser connection utilizing flexible ductwork.

(2) Insulated Flexible Duct (Use Only Where Indicated)

a. Owens/Corning or equivalent, 1 ½'' inch thick fiberglass insulation; flexible liner; with aluminum pigment vinyl vapor barrier facing. Insulated flexible duct shall meet Fire Hazards Standards of NFPA 90A and IMC, flame spread not to exceed 25, smoke develop and fuel contributed not to exceed 50 when tested in accordance with ASTM-E84. Minimum R-value of 6.0, tested in accordance with ASTM C177.71. Flexible duct may be used only for runouts and no sections shall be more than five feet in length.

b. When flexible duct is located in areas where it will be visible because the ceiling allows views to the ductwork above, the flexible duct shall be black. The black color shall be factory coloring and not field applied.

c. Flexible duct shall not be used in areas where there is no ceiling.

d. Flexible ductwork installed in a return or exhaust or other negative static pressure application shall be rated for installation in negative pressure systems

e. Provide Titus "FlexRight" or equal flexible duct bracing at each diffuser connection utilizing flexible ductwork.

(3) Insulated Flexible Duct – Steel or Aluminum (Use Only Where Indicated) [UK Requirement]

a. Flexible duct shall be a factory-fabricated assembly consisting of an all steel or aluminum material. Plastic with spiral wire flexible duct is not permitted.

b. All supply flexible duct shall be insulated with 1 ½ inch blanket of glass wool with an outer moisture barrier. The insulation assembly shall have a flame spread of not more than 25 and a smoke development rate of not over 50.

c. Flexible duct shall be rated for 10 inches W.G. static pressure.

d. A single length of flexible duct shall not exceed 4’0”.

e. The minimum bend radius shall be 1 ½ times the duct diameter. The radius shall be measured to the inside edge of the flexible duct.

f. Total offset in any run of flexible duct shall not exceed 90 degrees.

g. Provide a minimum of one hanger of each run of flexible duct. The hanger must be strapped around the flexible duct and secured to the structure above. Hangers shall not be attached to other mechanical or electrical objects. Hangers may be attached to an approved trapeze. Ceiling grid shall not be used to fabricate a trapeze. Support hangers shall be installed horizontal. Screws shall not be used to penetrate the flexible duct to attach the hanger.

h. Flexible duct shall be secured to the rigid duct and appliance with a nylon adjustable, self-locking, strap and a minimum of three sheet metal screws. The flexible duct shall be sealed airtight at each connection with self-adhesive aluminum tape. Fiber or cloth duct tape is not permitted to seal rigid or flexible duct.

i. All flexible duct shall be pressure tested by a testing and balancing agency to ensure the installation is airtight.

(4) Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A; neoprene coated glass fabric; 20 oz. for low pressure ducts secured with snap lock.

(5) Turning Vanes: Duro-Dyne or equivalent fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.

(6) Splitter Damper: Splitter damper shall be constructed of 16-gauge galvanized steel. Provide with operating hardware by Ventfabrics, Inc. to include damper blade bracket, ball joint bracket and operator shaft. Operator shall extend two inches from duct to allow for external insulation, where required. Regulator shall seal operator shaft air tight. Install hardware as recommended by manufacturer.

(7) Access Doors; In Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 1” thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for

servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils (water, electric, steam, etc.) and downstream side of VAV boxes and CAV boxes.

(8) Architectural Access Doors in Ceilings or Walls: Provide where required to access equipment, dampers, valves, filters, etc. Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24”x24” in size and constructed with 16 gauge galvannealed steel for door and frame. In finished areas, provide with primed steel with 1” border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1” border. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

(9) Security Architectural Access Doors in Walls: Provide where required to access equipment, dampers, valves, filters, etc.Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24”x24” in size and constructed with 12-gauge steel for door and frame. In finished areas, provide with primed steel with 1” border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1” border. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

(10) Volume Dampers (Rectangular): Ruskin, Model MD35 or Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air, Pottorf rectangular volume dampers. Frames shall be 4" x 1 "x 16-gauge galvanized steel. Blades shall be opposed blade 16-gauge galvanized steel with triple crimped blades on 6” centers. Linkage shall be concealed in jamb. Bearings shall be ½” nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

(11) Volume Dampers (Round): Ruskin, Model MDRS25 or, Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air, Pottorff round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel, 6" long. Damper blades shall be 20-gauge galvanized steel. Axle shall be 3/8"x6” square plated steel. Bearing shall be 3/8” nylon. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

(12) Fire Dampers: Fire dampers shall comply with IMC and shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 or 3-hour fire protection rating as required by fire wall. Damper shall have a 165°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing 16-gauge minimum steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. All fire dampers shall be dynamic. Static fire dampers are not allowed. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be Ruskin Type DIBD for 1-1/2-hour rating or Ruskin Type DIBD 23 for a 3-hour rating. Other acceptable manufacturers are Air Balance, Prefco, Greenheck, Nailor, or Safe Air. Provide an access door for fire damper reset at all fire damper locations.

(13) Motor Driven Smoke Dampers – Air Foil Blade: Provide Ruskin SD60 smoke damper where required by the locations of smoke partitions or as shown on the plans, whichever is more stringent. Other acceptable manufacturers are Air Balance or Pottorff. All smoke dampers shall be three inches larger than HVAC duct in each direction. Frame shall be a minimum of 18-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Each smoke damper shall be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close under HVAC system operating conditions) with pressures of at least the maximum possible of the HVAC system in the closed position, and the system maximum duct air velocity in the open position. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Actuator to be mounted outside of air stream. The pressure drop shall not be greater than .16" wg @ 2500 FPM when tested by an independent laboratory. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

(14) Motor Driven Fire/Smoke Dampers – Air Foil Blade: Fire damper shall be constructed and tested in accordance with UL Safety Standard 555. The damper shall be Ruskin FSD60. Other acceptable manufacturers are Air Balance or Pottorff. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Frame is to be a minimum of 16-gauge galvanized steel, rollformed into a structural hat shape channel. Frame seals shall consist of flexible, compression type stainless steel. The damper and actuator electric shall be rated to an elevated temperature or 250 degrees F or 350 degrees F. In addition, the damper must be factory supplied with actuator and sleeve to comply with the requirements of UL 555S. These dampers shall have been constructed and tested in

compliance with U.L. Standard 555 and U.L. Standard 555S, current editions. The pressure drop shall not be greater than .25 in.wg. At 2500 fpm when tested by an independent laboratory. Each damper shall bear an approved U.L. label identifying its classification as a Dynamic Rated Fire Damper (Static Rated dampers are not acceptable), and shall further be classified by U.L. as a Leakage Rated Damper for use in Smoke Control Systems. Each damper shall have a 1-1/2-hour fire protection rating, 212EF U.L. Listed fusible link and a leakage class I. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Provide factory supplied caulked sleeve, 20 gauge on dampers through 84" wide and 18 gauge above 84" wide. Actuator to be mounted outside of air stream. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

(15) Motor Driven Control Dampers – Provide Ruskin Model CD50 air foil damper as shown on the plans. Frame shall be a minimum of 16-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, 6 inches wide. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Blade seals shall be equal to Ruskinprene. Leakage Rating shall be Pressure/Class 1.

3. MEDIUM PRESSURE DUCTWORK

A. General (Medium Pressure)

(1) All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15" wg. Apply per manufacturer's recommendations.

(2) Ductwork shall be installed per SMACNA Medium or High-Pressure Manual, whichever is applicable. (Latest Edition shall apply.)

(3) All hanger straps shall be 18 ga. minimum with reinforcement angles installed in strict accordance with SMACNA. Flat oval ducts shall be installed with 2"x2"x1/4" angles on top and bottom ducts 18" wide and larger. Use 1"x1"x3/16" angles on ducts under 18" wide.

(4) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

(5) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow

hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type.

B. Materials (Medium Pressure Single Wall)

(1) All round, rectangular, and oval medium pressure ductwork for systems above 1.5" W.G. shall be Eastern Sheet Metal, United McGill or Semco or equal with construction as required by the latest SMACNA Standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section).

(2) Any ductwork exposed to view shall be double wall and constructed of galvanized steel. Galvanized metal shall be prepped and clean prior to painting. Coordinate with General Contractor.

Ductwork shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Ductwork shall be constructed of materials of the minimum weights or gauges as required by the latest SMACNA Standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section) or the below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum:

ROUND DUCT (or Equiv Ø for Flat Oval Ducts)		RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 14	26	UP TO 12	26
15 TO 26	24	13 TO 30	24
27 TO 36	22	31 TO 54	22
37 TO 50	20	55 TO 84	20
52 TO 60	18	85 AND ABOVE	18

(3) All medium pressure duct fittings shall be fabricated by the same manufacturer as the spiral pipe. Contractor or field fabricated fittings shall not be accepted. Duct fittings shall be constructed per the latest SMACNA standard (Refer to required pressure rating of the duct system as outlined in the Duct Schedule of this spec section) with continuous welds. Take-off fittings shall be combination type tees (Eastern Sheet Metal Model "CB" or equal). Straight or angle tees are not acceptable. Fittings shall be constructed of the following minimum gauges:

ROUND DUCT (or Equiv Ø for Flat Oval Ducts)		RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 50	20	UP TO 36	20
51 TO 60	18	37 TO 60	18
61 TO 84	16	61 AND ABOVE	16

(4) All single wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange on all ductwork greater than 24 inches in size.

C. Materials (Medium pressure Double Wall)

(1) Furnish and install where indicated by drawings or specifications medium pressure double wall duct. The double wall duct shall be United McGill Acoustic K27, SEMCO, Dixie or approved equivalent. The duct shall have a [perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23%.] [solid galvanized steel inner liner], an intermediate layer of fiberglass insulation minimum 1'' thick and an outer pressure shell. Duct shall be of spiral lock seam construction fabricated from galvanized steel meeting ASTM-A527 standard. The duct insulation shall have minimum R-value of 6.0. Medium pressure double wall fittings shall have the same construction features as the double wall duct. Duct shall be constructed of G90 Galvanized steel. Outer shell of ductwork shall be constructed of the minimum gauges specified above for single wall medium pressure ductwork.

(2) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.

D. Miscellaneous (Medium pressure)

(1) Flexible Connectors: Duro-Dyne, Ventfabrics, U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A or IMC, whichever is more stringent; neoprene coated glass fabric; 30 oz. for medium pressure ducts secured with bolted angles. Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.

(2) Architectural Access Doors In Ceilings or Walls: Provide where required to access equipment, dampers, valves, filters, etc. Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvannealed steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish.

In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

(3) Security Architectural Access Doors in Walls: Provide where required to access equipment, dampers, valves, filters, etc. Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12-gauge steel for door and frame. In finished areas, provide with primed steel with 1" border to accept architectural specified finish. In Mechanical, Electrical, or service spaces, provide brushed satin finish with 1" border. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

(4) Fire Dampers: Fire dampers shall comply with IMC and shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 or 3-hour fire protection rating as required by fire wall. Damper shall have a 165°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing 16-gauge minimum steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. All fire dampers shall be dynamic. Static fire dampers are not allowed. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be Ruskin Type DIBD for 1-1/2-hour rating or Ruskin Type DIBD 23 for a 3-hour rating. Other acceptable manufacturers are Air Balance, Prefco, Greenheck, Nailor, or Safe Air. Provide an access door for fire damper reset at all fire damper locations.

(5) Motor Driven Smoke Dampers – Air Foil Blade: Provide Ruskin SD60 smoke damper where required by the locations of smoke partitions or as shown on the plans, whichever is more stringent. Other acceptable manufacturers are Air Balance or Pottorff. Frame shall be a minimum of 18-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Each smoke damper shall be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. As part of the UL qualification,

dampers shall have demonstrated a capacity to operate (to open and close under HVAC system operating conditions) with pressures of at least the maximum possible of the HVAC system in the closed position, and the system maximum duct air velocity in the open position. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Actuator to be mounted outside of air stream. The pressure drop shall not be greater than .16" wg @ 2500 FPM when tested by an independent laboratory. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

(6) Motor Driven Fire/Smoke Dampers – Air Foil Blade: Fire damper shall be constructed and tested in accordance with UL Safety Standard 555. The damper shall be Ruskin FSD60. Other acceptable manufacturers are Air Balance or Pottorff. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, on 6" maximum centers. Frame is to be a minimum of 16-gauge galvanized steel, rollformed into a structural hat shape channel. Frame seals shall consist of flexible, compression type stainless steel. The damper and actuator electric shall be rated to an elevated temperature or 250 degrees F or 350 degrees F. In addition, the damper must be factory supplied with actuator and sleeve to comply with the requirements of UL 555S. These dampers shall have been constructed and tested in compliance with U.L. Standard 555 and U.L. Standard 555S, current editions. The pressure drop shall not be greater than .25 in.wg. At 2500 fpm when tested by an independent laboratory. Each damper shall bear an approved U.L. label identifying its classification as a Dynamic Rated Fire Damper (Static Rated dampers are not acceptable), and shall further be classified by U.L. as a Leakage Rated Damper for use in Smoke Control Systems. Each damper shall have a 1-1/2-hour fire protection rating, 212EF U.L. Listed fusible link and a leakage class I. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Appropriate electric actuators shall be installed by the damper manufacturer. Refer to building fire alarm and controls for exact type. Provide factory supplied caulked sleeve, 20 gauge on dampers through 84” wide and 18 gauge above 84" wide. Actuator to be mounted outside of air stream. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements

(7) Motor Driven Control Dampers – Provide Ruskin Model CD60 air foil damper as shown on the plans. Frame shall be a minimum of 16-gauge galvanized steel formed into a structural hat channel shaper with tabbed corners for reinforcement. The blade shall be airfoil shaped, constructed of a dual skinned galvanized steel, 14-gauge equivalent thickness, 6 inches wide. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Jamb seal shall be stainless steel flexible metal compression type. Blade seals shall be equal to Ruskinprene. Leakage Rating shall be Pressure/Class 1.

(8) Access Doors; In Rectangular Medium Pressure Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 1” thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a

hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position.

(9) Access Doors; In Round or Oval Medium Pressure Ductwork: All access doors in round or oval medium pressure ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers. Access door sizes shall be as follows:

DUCT DIAMETER	OPENING SIZE
3-4 inches	4" x 10"
5-6 inches	6" x 10"
7-24 inches	10" x 16"
26-36 inches	16" x 16"
Over 36 inches	16" x 22"

(10) Pressure Relief Doors: [Designer edit if required] Provide a pressure relief vent in the supply air ductwork at each air handling unit. It shall be located between the fan outlet and the first manual or automatic (i.e., fire, fire smoke, or any motorized) damper or closure device. It shall be sized to relieve the duct air pressure below the rated pressure construction of the ductwork and above the working pressure of the fan. The supply air relief door shall be Ruskin PRD18 or equal. Provide a vacuum relief vent in the return and/or outside air ductwork at each air handling unit. It shall be located between the air handling unit casing and the first manual or automatic damper or closure device. It shall be sized to relieve the duct vacuum below the rated construction of the ductwork and above the working negative pressure of the fan. The return air relief door shall be Ruskin NRD18 or equal. Automatic fan shutdown upon damper closure shall not be an acceptable protection for either overpressure or vacuum conditions. All duct pressure relief doors shall be of the automatic resetting type unless otherwise noted.

4. TYPE 1 KITCHEN RANGE HOOD EXHAUST DUCT

A. Ducts shall be constructed of 18-gauge stainless steel with liquid tight continuous external weld of all seams and joints where exposed. Where ducts are concealed, they shall be constructed of 16-gauge black steel with liquid-tight continuous weld of all seams and joints. Inside laps on duct joints shall project in a direction against the air flow.

B. Ducts shall be so constructed and sloped as to provide suitable drainage of grease to a collection point or to hood. At the base of each vertical riser or low point in ductwork, a residue trap shall be provided with provisions for cleanout per IMC. Ducts shall slope a minimum of ¼” per foot. Horizontal ducts exceeding 75 ft in length must slope a minimum of 1” per foot.

C. Hand holes for inspection and cleaning purposes, equipped with tight fitting sliding or swinging doors and latches, shall be provided in horizontal and vertical sections of exhaust ducts. Such openings shall be at the sides of the horizontal run in order to prevent dripping of residue. Spacing of such openings shall not exceed 20 feet and shall be located at all offsets and grease collection

points. Openings shall have a minimum dimension of 20" in width with a height equivalent to the duct height minus one inch.

D. No turning vanes or dampers shall be installed in type 1 grease duct.

E. The Contractor shall install the kitchen range hood exhaust duct systems and maintain the minimum code required clearances to combustibles. The use of UL listed and approved enclosure system of fire wraps/blankets installed per the manufacturer's instructions are acceptable when required to achieve the clearance to combustibles requirements.

F. At the Contractor's option and where noted on the plans, a UL2221 Pre-manufactured Duct System equal to Metal Fab 3G shall be acceptable. Duct shall have a stainless steel inner liner, aluminized outer liner and one or three-inch liner as required to comply with requirements of clearance to combustibles.

G. Shop drawings of the kitchen range hood exhaust ductwork shall be made and submitted to the appropriate reviewing agency. Any fees associated with this submittal shall be borne by this Contractor.

5. TYPE 2 KITCHEN RANGE HOOD EXHAUST DUCT

A. All type 2 kitchen range hood exhaust duct connected to hoods designated as foodservice item #'s [edit fs item #'s] is to be installed as required by dishwasher exhaust duct requirements.

B. All type 2 kitchen range hood exhaust duct connected to hoods designated as foodservice item #'s [edit fs item #'s] is to be installed as required by low pressure ductwork requirements.

6. DISHWASHER EXHAUST DUCT

A. All exposed exhaust duct shall be 22-gauge stainless steel duct with liquid tight continuous external weld of all seams and joints. All concealed exhaust duct shall be 24-gauge aluminum with liquid tight joints. Provide dielectric connection between steel and aluminum ductwork. All ductwork shall be sloped a minimum of 1/8" per foot so as to drain back toward the dishwasher.

7. DRYER VENT

A. All dryer ducting shall be a minimum of 4" in diameter. Refer to the drawings for exact duct sizing.

B. Dryer vent ductwork shall be rigid metal 20-gauge aluminum duct. Duct joints shall be installed so that the male end of the duct points in the direction of the airflow. Joints shall be secured with metal tape (not duct tape). Do not use rivets or screws in the joints or anywhere else in the duct as these will incur lint collection

C. Length of concealed rigid metal ducting shall not exceed the allowable length of 35 feet. Deduct 5 feet from the allowable length for every 4" 90-degree elbow and 4" 2.5 feet for every 45-degree fitting. lengths may vary per local codes and dryer manufacturer's recommendations. Install per

2012 IMC Section 504 Clothes Dryer Exhaust. Provide a complete, working in-line booster fan system, including power, if the maximum allowable duct length is exceeded.

D. Flexible transition hose connection at the dryer shall be the aluminum flexible duct type. Do not use the plastic or vinyl.

E. Termination of dryer venting shall be to the exterior with a proper hood or roof jack equipped with a backdraft damper. Hood/jack shall be painted with suitable exterior grade paint and color per the Owner's direction. Small orifice metal screening shall not be part of the hood or roof jack as this will trap lint and block the opening. The hood opening shall point down and maintain a minimum of 12 inches of clearance between the bottom of the hood and the ground or other obstruction.

8. DUCT SCHEDULE

A. Supply Ducts:

(1) Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, downstream of Terminal Units <Insert equipment>:

a. Pressure Class: Positive 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

(2) Ducts Connected to Constant-Volume Air-Handling Units <Insert equipment>:

a. Pressure Class: Positive [2][4, 6, or 10]-inch wg Refer to [Low Pressure requirements as outlined in section 2 of this spec] [Medium Pressure requirements as outlined in section 3 of this spec].
b. Minimum SMACNA Seal Class: [C] [A].
c. SMACNA Leakage Class for Rectangular: [24] [6].
d. SMACNA Leakage Class for Round and Flat Oval: [12] [3].

(3) Ducts Connected to Variable-Air Volume Air-Handling Units <Insert equipment>:

a. Pressure Class: Positive [4, 6, or 10]-inch wg Refer to medium pressure standards as outlined in section 3 of this spec.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:

(1) Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, downstream of Terminal Units <Insert equipment>:

a. Pressure Class: Negative 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

(2) Ducts Connected to Air-Handling Units <Insert equipment>:

a. Pressure Class: Negative [2][4, 6, or 10]-inch wg Refer to [Low Pressure requirements as outlined in section 2 of this spec] [Medium Pressure requirements as outlined in section 3 of this spec].
b. Minimum SMACNA Seal Class: [C] [A].
c. SMACNA Leakage Class for Rectangular: [24] [6].
d. SMACNA Leakage Class for Round and Flat Oval: [12] [3]

C. Exhaust/Relief Ducts:

(1) Ducts Connected to Exhaust Fans <Insert equipment>:

a. Pressure Class: Negative [2][4, 6, or 10]-inch wg Refer to [Low Pressure requirements as outlined in section 2 of this spec] [Medium Pressure requirements as outlined in section 3 of this spec].
b. Minimum SMACNA Seal Class: [C] [A].
c. SMACNA Leakage Class for Rectangular: [24] [6].
d. SMACNA Leakage Class for Round and Flat Oval: [12] [3]

(2) Ducts Connected to Air-Handling Units <Insert equipment>:

a. Pressure Class: Positive or Negative [2][4, 6, or 10]-inch wg Refer to [Low Pressure requirements as outlined in section 2 of this spec] [Medium Pressure requirements as outlined in section 3 of this spec].
b. Minimum SMACNA Seal Class: [C] [A].
c. SMACNA Leakage Class for Rectangular: [24] [6].
d. SMACNA Leakage Class for Round and Flat Oval: [12] [3].

(3) Ducts Connected to Laboratory Exhaust Fans <Insert equipment>:

a. Pressure Class: Negative [4, 6, or 10]-inch wg Refer to Medium Pressure requirements as outlined in section 3 as well as requirements outlined in the Hazardous Exhaust duct section of this spec.
b. Minimum SMACNA Seal Class: [A] [Welded seams, joints, and penetrations].
c. SMACNA Leakage Class: 3.

D. Outdoor Air Ducts:

(1) Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, downstream of Terminal Units <Insert equipment>:

a. Pressure Class: Positive 2-inch wg Refer to Low Pressure requirements as outlined in section 2 of this spec.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

(2) Ducts Connected to Air-Handling Units <Insert equipment>:

a. Pressure Class: Positive or Negative [2][4, 6, or 10]-inch wg Refer to [Low Pressure requirements as outlined in section 2 of this spec] [Medium Pressure requirements as outlined in section 3 of this spec].
b. Minimum SMACNA Seal Class: [C] [A].
c. SMACNA Leakage Class for Rectangular: [24] [6].
d. SMACNA Leakage Class for Round and Flat Oval: [12] [3].

12. Air Leakage Testing of the Ductwork Systems

A. It is the intent of this section to ensure the ductwork installed has minimal air leakage.

B. Air leakage testing shall be accomplished by an AABC or NEBB certified company. Refer to the Test & Balance specifications.

C. It is the intent to test all ductwork. The duct systems which will require testing are as follows: (Note to Designer to edit.)

(1) All supply air duct systems

(2) All return air duct systems.

(3) All exhaust air duct systems.

(4) All make-up air duct systems.

D. Do not insulate the supply air systems prior to testing.

E. The maximum allowable air leakage rate for each system tested must conform to SMACNA required leakage class rating as specified in section 11, DUCT SCHEDULE, of this spec.

F. The entire supply air ductwork system shall be tested with some exceptions. On VAV systems, the medium pressure ductwork upstream of the VAV boxes shall only be tested. Cap the duct at the inlet to the VAV box. On low pressure reheat system, all ductwork upstream of the hot water reheat coil shall be tested. The air volume damper and access door upstream of the reheat coil shall be included in the tested system. (Designer, edit above paragraph as required.)

G. All return and exhaust air sheet metal ductwork associated with the system shall be tested. Flexible ductwork shall not be tested. Cap the main duct prior to the central equipment fan

connection. Also cap the branch ducts which serve the diffusers, after the round branch air volume with sheet metal caps. Seal caps well to damper to avoid air loss at this location. This air loss, from the caps, is included in the noted leakage rate.

H. The noted allowable leakage rate is the total allowable. It shall include leakage associated with the following: (Note to Designer to edit.)

(1) All ductwork as described in above paragraphs.
(2) Access doors
(3) Volume dampers
(4) Relief air doors
(5) Smoke dampers
(6) Fire dampers
(7) Fire smoke dampers
(8) End caps used to seal ducts

I. If any duct system fails a test, the contractor shall reseal the system. It shall then be retested until the duct system meets the leakage allowable at no additional cost to the owner.

J. Carefully select the ductwork construction requirements and the type of duct sealant to be used as required to meet the leakage allowances. The sheet metal duct pressure classification is a minimum only. The contractor shall select the appropriate sheet metal pressure classification, duct sealant class and duct sealant materials to meet the project air leakage allowances.

K. Whenever the systems are being leak tested by the Test & Balance Contractor, a representative from the Mechanical Contractor shall be present to assist.

END OF SECTION 231200

SECTION 233400 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Comply with Division 01 section “Submittals Procedures”.

B. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.
8. Disconnect switches, variable speed control switches.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

D. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07, Section "Roof Accessories."

1.7 WARRANTIES

A. Refer to Division 01 Section “Warranties” for requirements.

B. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of power ventilators that fail in materials or workmanship within specified warranty period.

1.8 STARTERS

A. Single Phase Starters: Provide a 120 volt relay to be used as a starter for single phase units. Each unit shall be provided with a disconnect switch.

1. Relay shall be provided by the EMS Contractor.

B. Three Phase Starters: Three phase motor controllers (combination starters/disconnects) shall be provided by Div. 26.

1. See Division 26, Section 26 09 15 for other applicable requirements.

2. All motor controllers shall have indicating lights, phase loss relay, control power transformer and current sensing relays for interlock to the EMS.

3. Provide motor controllers with HOA switches and interlock “Auto” switch to EMS.

1.9 EXTRA MATERIALS

A. Refer to Division 01 Section “Extra Materials” for requirements.

1. Furnish extra materials described that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.10 EMS COORDINATION

A. Exhaust Fans: Provide controls for each fan as indicated on the drawings and in the Sequence of Operation.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck

2. Carnes Company HVAC

3. Loren Cook Company

4. Penn Ventilation

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing (Typical General Exhaust Fans): Removable, spun-aluminum, dome top and

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

F. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

4. Fan and motor isolated from exhaust airstream.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent. Use with direct drive fans for air balancing mounted at fan.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

4. Gravity Dampers: Parallel-blade dampers mounted in curb base with weighted to open when fan starts and factory set to close when fan stops.

H. Roof Curbs: Prefinished Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.

2. Overall Height: 16 inches above finished roof elevation.

3. Sound Curb: Curb with sound-absorbing insulation matrix. Provide for all science room general exhaust fans.

4. Pitch Mounting: Manufacture curb for roof slope.

5. Metal Liner: Galvanized steel.

6. Mounting Pedestal: Galvanized steel with removable access panel.

7. Vented Curb (kitchen exhaust duty only): Unlined with louvered vents in vertical sides.

I. Capacities and Characteristics: Refer to schedule as indicated on drawings.

2.2 EMS CONTROL:

A. All fans shall be controlled to start/stop, and prove status via the EMS. Refer to Division 23 Section, “Sequence of Operations for HVAC Controls” and mechanical control drawings for other applicable requirements.

2.3 MOTORS

A. Comply with requirements in Division 23, Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts, restrained elastomeric mounts, spring isolators, and restrained spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23, Section "Vibration Controls for HVAC Piping and Equipment."

1. Secure vibration controls to concrete bases using anchor bolts cast in concrete base.

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to architectural specifications for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and elastomeric hangers, spring hangers, or spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 23, Section "Sound and Vibration Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23, Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26, Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26, Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23, Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.5 DEMONSTRATION

A. Refer to Division 01 Section “Demonstration & Training” for requirements.

B. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain power ventilators as specified below:

1. Perform not less than 2 hours of training.

2. Train Owner’s maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining ventilators and fans.

3. Review data in maintenance manuals. Refer to Division 01, Section "Contract Closeout."

4. Review data in maintenance manuals. Refer to Division 01, Section "Operation and Maintenance Data."

5. Schedule training with Owner, through Architect, with at least seven days' advance notice.

6. Refer to Division 23 Section, “Sequence of Operations for HVAC Controls” and ensure control of each fan is in accordance with the Sequence of Operation section.

END OF SECTION 23 34 23

SECTION 237200 - HEAT WHEEL AIR-TO-AIR ENERGY RECOVERY UNITS

1. GENERAL

1.1 SUMMARY

A. This section includes Energy Wheel Air-to-Air Energy Recovery Ventilators for outdoor installation.
B. Related sections include the following:
   1. Section 20 01 00: General Provisions
   2. Section 22 02 00: Scope of Work
   3. Section 20 22 00: Insulation
   4. Section 23 12 00: Sheet Metal Ductwork
   5. Section 25 02 00: Controls and Instrumentation
   6. Division 26

1.2 SUBMITTALS

A. Product Data: For each type or model include the following:
   1. Complete fan performance curves for both the supply air and exhaust air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
   2. Energy wheel performance data for both summer and winter operation.
   3. Motor ratings, electrical characteristics, motor, and fan accessories.
   4. Combined efficiency data per ARI Guideline V-2003 for each model. Data shall include RER, COP, Unitary Net Cooling, Unitary EER and CEF.
   5. Material types and gauges of all component pieces and assemblies.
   6. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
   7. Estimated gross weight of each installed unit.
   8. Installation, Operating and Maintenance manual (IOM) for each model.
   9. Color chart including a palette of available standard paint finishes.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.
B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.
C. Product Options: Drawings must indicate size, profiles and dimensional requirements of Energy Recovery Units and are to be based on the specific system indicated. Refer to Division 1 Section “Product Requirements”.
D. Certifications:
   1. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.
   2. Energy wheel performance shall be AHRI Certified per Standard 1060.

1.4 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.
B. Coordinate sequencing of construction of associated HVAC, electrical supply [roofing contractor].

1.5 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. Filters: [(Insert quantity) set(s) of [MERV 8] or [MERV 13] disposable filters for each unit].
   2. One spare set of fan belts.
   3. One spare energy wheel belt.

2. PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
   1. Greenheck (Basis of Design)
   2. RenewAire
   3. Ruskin

2.2 MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturned outdoor air intake weatherhood with metal mesh filters, energy wheel, motorized intake damper, motorized exhaust damper, sensors, curb assembly, service receptacle, frost control, filter assembly for intake and exhaust air, supply air blower assembly, exhaust air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

2.3 CABINET

A. Materials: Formed double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish.
   2. Internal assemblies: 18 gauge, galvanized (G90) steel, except for motor supports which shall be minimum14 gauge galvanized (G90) steel.
B. Access doors shall be hinged.
C. Shall have factory-installed duct flanges on all duct openings.
D. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
    a. Thickness: 1 inch (25 mm)
    b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
    c. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.

E. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned drive belt. The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and shall be designed and constructed to permit cleaning and servicing. The energy wheel is to have a five-year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

F. Supply Air and Exhaust Air blower assemblies: Blower assemblies consist of an electric motor as specified by A/E and a belt driven blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on 1.125-inch-thick neoprene vibration isolators.

G. Control panel/connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections

H. Frost control: Modulating Wheel.

I. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.

J. Economizer Control: [None] [Stop Wheel] [Modulating Wheel] [VFD Signal by Others] [BMS Control]

K. Motorized Dampers: Motorized dampers of [low leakage] [insulated low leakage] type and leakage rate of 3 CFM/ft^2 @ 1 in. wg shall be factory installed.

L. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.

M. Curb Assembly: A curb assembly made of 18-gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

N. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed by this contractor in a location designated by the A/E.

2.4 BLOWER

A. Blower section construction, Supply Air and Exhaust Air: Belt drive motor and blower shall be assembled onto a 14-gauge galvanized steel platform and must have neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow that are mechanically attached to shaft with set screws.
E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5 MOTORS

A. General: Blower motors greater than ¾ horsepower shall be "NEMA Premium™" unless otherwise indicated. Minimum compliance with EPAct minimum energy-efficiency standards for single speed ODP and TEFC enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase, and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.
B. Motors shall be 60 cycle, 1 phase 208 volts.

2.6 UNIT CONTROLS

A. The unit shall be constructed so that it can be controlled by a factory-supplied controller or it can be monitored and controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status, operating settings, and alarm conditions. DDC controller shall have a built-in keypad to permit operator to access read-out screens and change settings without the use of ancillary equipment, devices, or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.
    1. Operating protocol: The microprocessor shall be factory-programmed for BACnet MSTP or BACnet IP for monitoring of the unit's status. Mechanical contractor is responsible for confirming MSTP or IP prior to purchase of equipment.
C. Variable Frequency Drive (VFD) - Unit shall have factory installed variable frequency drives for modulation of the blower motors. The VFDs shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.
D. Supply fan shall be configured for constant volume.
E. Exhaust fan shall be configured for constant volume.
F. Airflow monitoring required in the supply & exhaust airstreams.
G. Sensors
    1. Dirty Filter Sensors

2. CO2 Sensor
3. Temperature Sensors- OAI, EAD, RAI, OAD
4. Relative Humidity Sensors – OAH, RAH
5. Rotation Sensor

3.7 FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 13 disposable pleated filters shall be provided in the intake air stream and MERV8 filters in the exhaust air stream.

3. EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, best practices, and all applicable building codes.

3.3 CONNECTIONS

A. In all cases, industry best practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
   1. Duct installation and connection requirements are specified in Division 23 of this document.
   2. Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage an authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed start-up checklists as found in manufacturer's IOM.

3.5 START-UP SERVICE

A. Engage an authorized service representative to perform startup service. Clean entire unit and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING:

A. Engage an authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION 237200

SECTION 237400 – PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Packaged Rooftop air conditioners

1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes

D. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

E. AHRI 340/360 - Unitary Large Equipment

F. NEMA MG1—Motors and Generators

G. National Electrical Code.

H. NFPA 70—National Fire Protection Agency.

I. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

J. UL 900—Test Performance of Air Filter Units.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.

2. Provide computer generated fan curves with specified operating point clearly plotted.

3. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Daikin Applied

1. APPROVED ALTERNATE MANUFACTURERS

a. AAON

b. KCC HORIZON (TRANE)

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single zone Heating and Cooling Unit(s) model DPS. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Gas heating section.
6. Condensing unit section

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2016 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.

F. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 OUTDOOR/RETURN AIR SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

B. Provide a field installed Duct/Space mounted C02 sensor. Outside air damper position will modulate between the Demand Control Ventilation Limit (minimum position setpoint) and the Ventilation Limit (maximum non-economizer position setpoint) to satisfy the space requirements. Damper position will be controlled to the greater of the two command signals, either minimum outside air flow or space IAQ (CO2).

C. Economizer assembly Fault Detection and Diagnostics (FDD) shall be 90.1, IECC, and California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with 90.1, IECC, and Title 24 specifications.

2.05 ENERGY RECOVERY

A. The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.

B. The wheel capacity, air pressure drop and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers For Energy Recovery Ventilation Equipment.

C. The rooftop unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.

D. The unit shall have 2" Merv 7 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door with ¼ turn latches.

E. The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

F. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

G. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning.

H. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.

I. The exhaust air fan shall be a direct drive SWSI plenum fan. The exhaust fan shall be sized for the airflow requirements per the construction schedule. The unit controller shall control the exhaust fan to maintain building pressure. A VFD shall be provided for the exhaust fan motor or the exhaust fan motor shall be an ECM motor.The rooftop unit shall have single point electrical power connection and shall be ETL listed.

J. The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface.

K. The rooftop unit with the energy recovery wheel shall incorporate the economizer operation. The energy recovery wheel shall have a bypass damper. When the unit is in the economizer mode of operation the energy recovery wheel shall stop and the bypass dampers shall be opened. The outdoor air shall be drawn through the bypass dampers to reduce the pressure drop of the outdoor airstream.

L. The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall stop the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

2.06 EXHAUST FAN

A. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

C. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.07 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 and 4" MERV 14 filters.

2.08 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of

1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

F. A drain pan over flow safety shall shut off the unit and issue a warning before over flow occurs.

2.09 HOT GAS REHEAT

A. Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser

B. Hot gas reheat coil shall be a Micro Channel design. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.

C. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.

D. Each coil shall be factory leak tested with high-pressure air under water.

2.010 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additonal maintenance.

B. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

C. Supply fan and motor assembly combinations larger than 8 hp or 22” diameter shall be internally isolated on 1” deflection, spring isolators and include removable shipping tie downs.

D. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

E. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.011 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. The module shall be complete with furnace controller and control valve capable of 5:1 modulating operation.

C. The module shall be complete with furnace controller and control valve capable of 10:1 modulating operation.

D. The heat exchanger tubes shall be constructed of stainless steel.

E. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

F. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

G. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.012 HEAT PUMP HEATING

A. The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heatpump operation. The refrigerant circuit shall contain a 4 way reversing valve for the heatpump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

B. The refrigerant system shall have a pump-down cycle.

C. The unit shall have a natural gas furnace for hybrid heating. When the heatpump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.

2.013 CONDENSING SECTION

A. Outdoor coils shall have seamless copper tubes, mechanically bonded into aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 25~120°F. Mechanical cooling shall be provided to 25º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

C. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite materia

D. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line.

E. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

F. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

G. Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

2.014 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

2.015 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Return air temperature.
2. Discharge air temperature.
3. Outdoor air temperature.
4. Space air temperature.
5. Outdoor enthalpy, high/low.
6. Compressor suction temperature and pressure
7. Compressor head pressure and temperature
8. Expansion valve position
9. Condenser fan speed
10. Inverter compressor speed
11. Dirty filter indication.
12. Airflow verification.
13. Cooling status.
14. Control temperature (Changeover).
15. VAV box output status.
16. Cooling status/capacity.
17. Unit status.
18. All time schedules.
19. Active alarms with time and date.
20. Previous alarms with time and date.
21. Optimal start
22. Supply fan and exhaust fan speed.
23. System operating hours.
    a. Fan
    b. Exhaust fan
    c. Cooling
    d. Inndividual compressor
    e. Heating
    f. Economizer
    g. Tenant override

G. The user interaction with the keypad shall provide the following:

1. Controls mode
    a. Off manual

b. Auto
c. Heat/Cool
d. Cool only
e. Heat only
f. Fan only

2. Occupancy mode
   a. Auto
   b. Occupied
   c. Unoccupied
   d. Tenant override
3. Unit operation changeover control
   a. Return air temperature
   b. Space temperature
   c. Network signal
4. Cooling and heating change-over temperature with deadband
5. Cooling discharge air temperature (DAT)
6. Supply reset options
   a. Return air temperature
   b. Outdoor air temperature
   c. Space temperature
   d. Airflow (VAV)
   e. Network signal
   f. External (0-10 vdc)
   g. External (0-20 mA)
7. Temperature alarm limits
   a. High supply air temperature
   b. Low supply air temperature
   c. High return air temperature
8. Lockout control for compressors.
9. Compressor interstage timers
10. Night setback and setup space temperature.
11. Building static pressure.
12. Economizer changeover
    a. Enthalpy
    b. Drybulb temperature
13. Currently time and date
14. Tenant override time
15. Occupied/unoccupied time schedule
16. One event schedule
17. Holiday dates and duration
18. Adjustable set points
19. Service mode
    a. Timers normal (all time delays normal)

b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:

1. Zone sensor with tenant override switch
2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:

1. Airflow
2. Outside air temperature
3. Space temperature
4. Return air temperature
5. External signal of 1-5 vdc
6. External signal of 0-20 mA
7. Network signal

2.016 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." and ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07, Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.03 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to **roof surface, away from all access walkways and maintenance areas for the unit**, and as acceptable to the authority having jurisdiction.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Duct installation requirements are specified in other Division 23, Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.

2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23, Section "Air Duct Accessories."

4. Install return-air duct continuously through roof structure.

3.04 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.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.

2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Verify communication established with EMS.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.

2. Inspect for visible damage to furnace combustion chamber.

3. Inspect for visible damage to compressor, coils, and fans.

4. Inspect internal insulation.

5. Verify that labels are clearly visible.

6. Verify that clearances have been provided for servicing.

7. Verify that controls are connected and operable.

8. Verify that filters are installed.

9. Clean condenser coil and inspect for construction debris.

10. Clean furnace flue and inspect for construction debris.

11. Connect and purge gas line.

12. Remove packing from vibration isolators.

13. Inspect operation of barometric relief dampers.

14. Verify lubrication on fan and motor bearings.

15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.

16. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.

    b. Do not operate below recommended low-ambient temperature.

    c. Complete startup sheets and attach copy with Contractor's startup report.

17. Inspect and record performance of interlocks and protective devices; verify sequences.

18. Operate unit for an initial period as recommended or required by manufacturer.

19. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.

    b. Inspect operation of power vents.

    c. Measure combustion air temperature at inlet to combustion chamber.

    d. Measure flue gas temperature at furnace discharge.

    e. Perform flue gas analysis. Measure and record flue gas carbon dioxide and oxygen concentration.

    f. Measure supply air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

20. Calibrate thermostats.

21. Adjust and inspect high-temperature limits.

22. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.

23. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

a. Coil leaving-air, dry- and wet-bulb temperatures.

b. Coil entering-air, dry- and wet-bulb temperatures.

c. Outdoor-air, dry-bulb temperature.

d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

24. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.

25. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

a. Supply-air volume.

b. Return-air volume.

c. Relief-air volume.

d. Outdoor-air intake volume.

26. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.

b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

27. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

a. High temperature limit on gas fired heat exchanger.

b. Low-temperature safety operation.

c. Filter high-pressure differential alarm.

d. Economizer to minimum outdoor-air changeover.

e. Relief-air fan operation.

f. Smoke and firestat alarms.

28. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.06 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION

A. Refer to Division 01 Section, “Demonstration & Training” for requirements.

B. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain packaged rooftop HVAC units as specified below:

1. Perform not less than 16 hours of training.

2. Train Owner’s maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining packaged rooftop HVAC units.

3. Review data in maintenance manuals. Refer to Division 01, Section "Contract Closeout."

4. Review data in maintenance manuals. Refer to Division 01, Section "Operation and Maintenance Data."

5. Schedule training with Owner, through Architect, with at least seven days' advance notice.

6. Contractor shall provide all materials and labor necessary to demonstrate system operation to Architect/Engineer as required by Division 23, Section “Commissioning of the HVAC System.” The contractor shall repeatedly make site visits, demonstrate and make revisions to system at their own expense until all systems are accepted by the Architect and Engineer.

END OF SECTION 237400

SECTION 238100 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

B. Coordinate with Division 26 to ensure the units are wired in accordance with the manufacturer's recommendations for a complete operating system.

1.2 SUBMITTALS

A. Comply with Division 01 section "Submittals Procedures".

B. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

C. Shop Drawings: Diagram power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain air-conditioning units, components, devices, and other associated accessories through one source from single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01, Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 07 - "Construction and Startup."

E. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Division 06 Section "Heating, Ventilating, and Air-Conditioning."

1.4 COORDINATION

A. Coordinate size and location of concrete bases for units (ground-mount units only). Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03, Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs/rails, equipment supports, and roof penetrations specified in Division 07, Section "Roof Accessories."

1.5 WARRANTIES

A. Refer to Division 01 Section “Warranties” for requirements.

B. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin.
2. Mitsubishi.
3. Trane.
4. York.
5. LG.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Factory fabricated with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2007.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23, Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multi-tapped, multi-speed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or Scroll.

2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

3. Refrigerant: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Fan: Aluminum-propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

F. Low Ambient Kit: Permits operation down to 0 deg F.

G. Mounting Base: Polyethylene.

H. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2007, "Energy Standard for Buildings except Low-Rise Residential Buildings."

I. Equipment Supports (Roof-mounted): Refer to Division 07, Section "Roof Accessories."

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

1. Minimum Insulation Thickness: 1 inch thick.

2.5 CONTROLS

A. Provide wall mounted thermostat for each ductless system.

B. System shall be enabled 24/7 to cool the data rooms and MDF room.

2.6 ELECTRICAL POWER

A. Provide electrical voltage and phase to match approved submittal data.

B. Provide power to outdoor condensing unit then to indoor unit in accordance with manufacturer’s recommended installation instructions.

C. Provide non-fused disconnecting means for indoor and outdoor units in accordance with NEC and the local authorities having jurisdiction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports specified in Division 07, Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Refrigerant piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26, Section "Grounding and Bonding for Electrical Systems."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Refer to Division 01 Section, “Demonstration & Training” for requirements.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain split-system units.

1. Video record training sessions.

2. Instructor shall be factory trained and certified.

3. Provide not less than 4 hours of training.

4. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.

5. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.

6. Obtain Owner sign-off that training is complete.

7. Owner training shall be held at Project site.

END OF SECTION 23 81 26

SECTION 238200 - VARIABLE REFRIGERANT VOLUME AIR CONDITIONING

PART 1 – GENERAL

1.1 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

B. All wiring shall be in accordance with the National Electric Code (NEC).

C. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

D. Any approved manufacturer shall be rated and certified in accordance with AHRI standard 1230 and meet minimum efficiencies as scheduled.

E. The approved manufacturer shall have parts, equipment and materials stocked within 50 miles of installed location.

F. The approved manufacturer shall have factory trained service technicians available and within 50 miles of installed location.

G. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2010 and installed to resist the wind pressures on the equipment and the supports.

H. The condensing unit will be factory charged with R410A.

1.2 LEED BUILDING – GENERAL REQUIREMENTS

A. Implement practices and procedures to meet the project's environmental goals, which include achieving a LEED™ version 4 for Building Design and Construction (BD+C) GOLD rating. Specific project goals which may impact this and the other sections of this specification include: tracking life cycle impact of materials using environmental product declarations; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction and demolition waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated LEED Building criteria.

B. Comply with LEED v4 BD+C GOLD as outlined in the LEED Project checklist provided in Section 018113, Sustainable Design Requirements.

1.3 RELATED SECTIONS

A. Section 013300 – SUBMITTAL REQUIREMENTS

B. Section 017419 – CONSTRUCTION & DEMOLITION WASTE MANAGEMENT

C. Section 018113 – SUSTAINABLE DESIGN REQUIREMENTS

D. Section 018117 – LOW EMITTING MATERIAL REQUIREMENTS

E. Section 018119 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

F. Section 312513 – EROSION AND SEDIMENTATION CONTROL

1.4 SUBMITTALS

A. LEED Submittal Requirements – The contractor/subcontractor shall submit the following LEED Building certification items:

1. A completed LEED Environmental Product Declaration Form, LEED Product Disclosure and Optimization Certification Form, LEED v4 Low Emitting Materials Certification Form, per Section 013300 – Submittal Requirements under the LEED BUILDING Submittal Requirements article of these specifications.

2. Materials for which product-specific Type III Environmental Product Declarations (EPDs), industry-wide (generic) EPDs, or publicly available cradle-to-gate life-cycle assessments conforming to ISO 14044 are available shall be documented in accordance with the LEED Building Submittal Requirements of Division 1, Section 013300 Submittal Requirements.

3. Materials for which Health Product Declarations, Cradle to Cradle v2 Basic level or Cradle to Cradle v3 Bronze level certificates, ILFI Declare labels, or manufacturer inventories that disclose a product's chemical inventory to at least 0.1% (1000 ppm) are available shall be documented in accordance with the LEED Building Submittal Requirements of Division 1, Section 013300 Submittal Requirements.

4. Product Cut Sheets for all materials that meet the LEED Building Performance Requirements of this Section.

5. Safety Data Sheets (SDS), for all permanently-installed applicable products. Applicable products include, but are not limited to adhesives, sealants, paints and coatings applied on the interior of the building. SDS shall indicate the Volatile Organic Compound (VOC) limits of products submitted as well as the laboratory testing reports showing compliance with requirements for low-emitting materials set forth in Division 01, Section 018117. If an SDS does not include a product's VOC content, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the SDS to indicate the VOC content.

1.5 SYSTEM DESCRIPTION

A. The variable capacity, heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) split system as specified. The system shall consist of multiple evaporators, REFNET™ joints and headers, a three-pipe refrigeration distribution system using PID control and Daikin VRV® condenser unit. The condenser shall be a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant. Each condensing unit shall use high efficiency, variable

speed all “inverter” compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions. Indoor units shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency. The condensing unit shall have capability to connect an indoor evaporator capacity up to 200% of the condensing unit capacity. All zones are each capable of operating separately with individual temperature control. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance. Two-pipe, heat recovery systems requiring separation of the gas and liquid refrigerant shall be furnished with auxiliary electric heating coils. Contractor is responsible for any change to electrical requirements.

B. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with one branch cool/heat selector box. Each indoor unit or group of indoor units shall be able to provide set temperature independently via an Intelligent Controller and a BACnet BMS interface.

C. Branch selector (BS) boxes shall be located as shown on the drawing. The branch selector boxes shall contain the refrigerant control piping and electronics to facilitate communications between the BS box and main processor and between the BS box and indoor units. The BS box shall control the operational mode of the subordinate indoor units.

1.6 ADDITIONAL REQUIRED FEATURES

A. Advanced Zoning – A single system shall provide for up to 64 zones.

B. Autocharging – Each system shall have a refrigerant auto-charging function. If Autocharging is not available alternate manufacturer shall furnish refrigerant charge calculation for each system prior to startup.

C. Defrost Heating – Each system shall maintain continuous heating during defrost operation. Systems not capable of doing simultaneous heating and defrost shall be provided with electric heaters for all indoor and shall also provide de-rated performance accounting for heat removed from the system at ambient conditions of 17/16. Cost of heap pump size upgrade, electrical upgrade, installation and control shall be responsibility of the contractor.

D. Oil Return Heating – Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.

E. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve for independent control.

F. VFD Inverter Control & Variable Refrigerant Temperature – Each condensing unit shall use high efficiency, variable speed all “inverter” compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant

volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.

G. Indoor units shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency. Indoor units shall control to within one-degree F deadband.

H. Connection Ratios – The condensing unit shall have the ability to connect an indoor unit evaporator capacity of down to 50% and up to 200% of the condensing unit capacity. Alternative manufacturers shall submit data confirming connection ratio is adequate for calculated diversity factor.

I. Simple Wiring – Systems shall use 16/18 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.

J. Advanced Diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

K. Each condensing unit shall incorporate contacts for electrical demand shedding.

L. Each system shall be capable of integrating with open protocol BACnet and LonWorks building management systems.

M. Provide full and unlocked version of the manufacturer's "Service Tool" for post-occupancy servicing by Owner's agent.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The units shall be stored and handled according to the manufacturer's recommendations.

1.8 PHYSICAL CHARACTERISTICS

A. General: The advanced multi-zone controller shall be made from plastic materials with a neutral color. Each control shall have a LCD (Liquid Crystal Display) that shows On/Off, setpoint, room temperature, mode of operation (Cool/Heat/Dry/Fan/Auto), louver position, and fan speed.

1.9 ELECTRICAL CHARACTERISTICS

A. General: The advanced multi-zone controller will require 24 VAC to power the controller. The advanced multi-zone controller shall supply 16 volts DC to the communication bus on the F1F2 (out-out) terminal of the outdoor unit. The voltage may rise or fall in relation to the transmission packets that are sent and received.

B. Wiring: The advanced multi-zone controller communication wiring shall be terminated in a daisy chain design at the outdoor unit, which is then daisy chained to branch selector (Heat Recovery system), then daisy chained to each indoor unit in the system and terminating at the farthest indoor unit. The termination of the wiring shall be non-polar. The remote control wiring shall run from the indoor unit control terminal block to the remote controller connected with that indoor unit.

C. Wiring size: Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable, and 18 AWG stranded copper wire.

1.10 VRV CONTROL NETWORK

A. The VRV Controls Network is made up of local remote controllers, multi-zone controllers, advanced multi-zone controllers, and open protocol network devices that transmit information via the communication bus. The VRV Controls Network shall also have the ability to be accessed via a networked PC. The VRV Controls Network supports operation monitoring, scheduling, error e-mail distribution, general user software, tenant billing, maintenance support, and integration with Building Management Systems (BMS) using open protocol via BACnet or Lonworks interfaces; all of which blend to provide the optimal control strategy for the best HVAC comfort solution.

1.11 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

B. All wiring shall be in accordance with the National Electric Code (NEC).

C. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

D. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2010 and installed to resist the wind pressures on the equipment and the supports.

E. The condensing unit will be factory charged with R410A.

F. LEED Building Performance Requirements

a. Adhesives, sealants, paints or coatings used for work in this section for permanent interior applications shall meet the chemical requirements of Division 1, Section 018117: “Low Emitting Material Requirements”, as applicable.

b. A minimum of twenty (20) different products from a minimum of five (5) separate manufacturers shall have product-specific Type 3 Environmental Product Declarations that comply with LEED requirements; industry-wide (generic) Environmental Product Declarations shall be accepted and valued at one-half of a product (requiring 40 different products); ISO 14044 compliant cradle-to-gate life-cycle assessments shall be accepted and valued at one-quarter of a product (requiring 80 different products).

c. A minimum of twenty (20) different products from a minimum of five (5) separate manufacturers shall comply with the LEED requirements for material ingredient reporting. Acceptable Material Product Declarations include the following:

i. Manufacturer Inventory disclosing chemical inventory to at least 0.1% (1000 ppm)

ii. Health Product Declaration disclosing chemical inventory to at least 0.1% (1000 ppm)

iii. Cradle to Cradle certification (v2 Basic or v3 Bronze)

iv. Declare label

1.12 STANDARD LIMITED WARRANTY

A. The manufacturer shall warrant to the customer who is the original owner and user of the Daikin AC products specified above ("Customer") that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material or workmanship. This warranty applies to parts only and is limited in duration to ten (10) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment. Customer must present proof of the original date of receipt and of installation of the Product in order to establish the effective date of this warranty. Otherwise the effective date will be deemed to be the date of manufacture plus sixty (60) days. Repaired or replacement parts are warranted for the balance of the warranty period applicable to the original part following the date on which the repaired or replacement part is provided to the Customer.

B. Warranty shall be by the equipment manufacturer. Third party warranties shall only be allowed if the equipment seller is co-listed as responsible for the warranty should the third-party warrantor not perform.

1.13 INSTALLATION REQUIREMENTS

A. **The system must be installed by a factory trained contractor/dealer by Daiken. The bidders shall be required to submit training certification proof with bid documents. Training shall have been completed within the past two (2) years. The mechanical contractor's installation price shall be based on the systems installation requirements. The mechanical contractor bids with complete knowledge of the HVAC system requirements.**

1.14 OPERATING RANGE

A. The operating range in cooling will be 23°F DB ~ 122°F DB.

B. The operating range in heating will be -13°F WB – 60°F WB.

C. Simultaneous cooling/heating operating range will be -13°F WB – 60°F WB.

D. Cooling mode indoor room temperature range will be 57°F-77°F WB.

E. Heating mode indoor room temperature range will be 59°F-80°F DB.

1.15 REFRIGERANT PIPING

A. The system shall be capable of refrigerant piping up to 540 actual feet or 620 equivalent feet from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280 feet of piping between the condensing and indoor units with 295 feet maximum vertical difference, without any oil traps. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance. Code compliant copper piping shall be acceptable. Refrigerant pipe insulation shall be no less than ¾ inch thick HVAC refrigerant pipe insulation rated for indoor or outdoor, based on location used.

1.16 DESIGN BASIS

A. The HVAC equipment basis of design is Daikin AC. Other approved equivalent listed manufacturers are as follows:

   a. Mitsubishi
   b. Samsung

B. All bidders shall furnish the minimum system standards as specified herein.

PART 2 – PRODUCTS

2.1 CONDENSING UNIT

A. General:
   1. The condensing unit shall be factory assembled in the United States and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.
   2. Liquid and suction lines must be individually insulated between the condensing and indoor units.
   3. The condensing unit can be wired and piped with access from the left, right, rear or bottom
   4. The connection ratio of indoor units to condensing unit shall be permitted up to 200%.
   5. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
   6. The condensing unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
   7. The following safety devices shall be included on the condensing unit; high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
   8. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
   9. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature. If alternative manufacturer's system is incapable of heating during oil return, electric heating coil shall be furnished. Contractor is responsible for any change to electrical requirements, due to additional electrical requirements of electric heating coil.
   10. The condensing unit shall be capable of heating operation at -13°F dry bulb ambient temperature without additional low ambient controls or an auxiliary heat source.
   11. The system shall continue to provide Heat during Defrost to the indoor units while in the defrost mode. Reverse cycle defrost during heating operation shall not be permitted due to the potential reduction in space temperature. If alternative manufacturer's system is incapable of Heating during Defrost, optional electric heating coil shall be furnished for all

indoor units. Contractor is responsible for any change to electrical requirements, due to additional electrical requirements of electric heating coil.

B. Unit Cabinet:
   1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Fan:
   1. The condensing unit shall consist of one or more propeller type, direct-drive 350 or 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
   2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
   3. The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 5,544 CFM to 24,684 CFM dependent on model specified.
   4. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
   5. The fan motor shall be provided with a fan guard to prevent contact with moving parts.
   6. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps as shown below.

Operation Sound (dB)	Night Mode Sound Pressure Level (dB)
Step 1 max.	55
Step 2 max.	50
Step 3 max.	45

D. Condenser Coil:
   1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
   3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
   4. The fins are to be covered with an anti-corrosion Ulta Gold coating as standard with a salt spray test rating of 1000 hours, acetic acid salt spray test of 500 hours. Manufacturers whose AHRI ratings do not reflect capacity reduction due to coatings shall be derated by 5%.
   5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
   6. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for bottom plate heater. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation enhancing the defrost operation.
   7. The condensing unit shall be factory equipped with condenser coil guards on all sides.

E. Compressor:
1. The inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value. Non inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.
2. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll "G-type" or "J-type."
3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as low as 3% to 100%.
5. The compressors' motors shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings
6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Oil separators shall be standard with the equipment together with an intelligent oil management system.
8. The compressor shall be spring mounted to avoid the transmission of vibration.
9. Units sized 6 tons shall contain a minimum of 1 compressor. 8-14 ton units shall contain a minimum of 2 compressors. 16 ton units shall contain a minimum of 3 compressors. 22-28 ton units shall contain a minimum of 4 compressors. 30-36 ton units shall contain a minimum of 6 compressors. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
10. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours.

F. Electrical:
1. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.
3. The control wiring lengths shall be as shown below.

	Condenser to Indoor Unit	Condenser to Central Controller	Indoor Unit to Remote Control
Control Wiring Length	6,665 ft	3,330 ft	1,665 ft
Wire Type	16/18 AWG, 2 wire, non-polarity, non-shielded, stranded		

2.2 INDOOR VRV AIR HANDLING UNIT AND CONTROL

FXFQ – ROUND FLOW CEILING CASSETTE UNIT (3'x3')

A. General: Daikin indoor unit model FXFQ shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 9,500 Btu/h to 48,000 Btu/h. It shall be a round flow air distribution type, fresh white, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E71 and BRC2A71. The indoor units sound pressure shall range from 27 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.

B. Performance: As Scheduled

C. Indoor Unit:
   1. The Daikin indoor unit FXFQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3. Both refrigerant lines shall be insulated from the outdoor unit.
   4. The round flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.
   5. Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
   6. The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump provides up to 33-1/2" of lift and has a built in safety shutoff and alarm.
   7. The indoor units shall be equipped with a return air thermistor.
   8. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   9. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The cabinet shall be space saving and shall be located into the ceiling.
   2. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
   3. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
   4. Fresh air intake shall be possible by way of Daikin's optional fresh air intake kit.
   5. A branch duct knockout shall exist for branch ducting of supply air.
   6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
   7. Optional high efficiency MERV 13 air filters are available for each model unit.

E. Fan:
1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.08 to 0.16 HP.
3. The airflow rate shall be available in three settings.
4. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the Daikin MERV 13 filter options.
5. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin and antibacterial treatment.
2. Optional high efficiency disposable MERV 13 filters shall be available.
3. Optional Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/4 inch outside diameter PVC.
5. A condensate pan with antibacterial treatment shall be located under the coil.
6. A condensate pump with a 33-1/2 inch lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional BACnet gateways.
3. The unit shall be compatible with a Daikin intelligent Touch advanced multi-zone controller or an intelligent Manager III customizable BMS.
4. For the Sensing functions and the optional Self-Cleaning Filter functions, Remote controller BRC1E52B7 shall be used. Consult with Daikin prior to applying controls.

J. Optional Accessories Available:
   1. A high efficiency disposable MERV 13 air filter kit.
   2. Fresh air intake kit (KDDP55B160(K) – Maximum 10-15% untreated Outside Air
   3. Supply air branch duct connections.
   4. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.
   5. Remote "in-room" sensor kit (KRCS01-4B).
      a. The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

FXZQ – 4 WAY CEILING CASSETTE UNIT (2'x2')

A. General: Daikin indoor unit model FXZQ shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 18,000 Btu/h. It shall be a four-way air distribution type, white (RAL9010), impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E71 and BRC2A71. The indoor units sound pressure shall range from 29 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.

B. Performance: As Scheduled

C. Indoor Unit:
   1. The Daikin indoor unit FXZQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3. Both refrigerant lines shall be insulated from the outdoor unit.
   4. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
   6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 21" of lift and has a built in safety shutoff and alarm.
   7. The indoor units shall be equipped with a return air thermistor.
   8. All electrical components are reached through the decoration panel, which reduces the required side service access.
   9. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   10. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be space saving and shall be located into the ceiling.
2. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
3. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
4. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
5. A branch duct knockout shall exist for branch ducting supply air.
6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.12 HP.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.
5. A condensate pan shall be located under the coil.
6. A condensate pump with a 21 inch lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional BACnet gateways.

3. The unit shall be compatible with a Daikin intelligent Touch advanced multi-zone controller or an intelligent Manager III customizable BMS. Consult with Daikin prior to applying controls.

J. Optional Accessories Available:
   1. Direct fresh air intake kit (KDDQ44X60).
   2. Supply air duct connections.
   3. Remote "in-room" sensor kit (KRCS01-1B).
      a. The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

FXAQ – WALL MOUNTED UNIT

A. General: Daikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design with finished white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E71 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. Performance: As Scheduled

C. Indoor Unit:
   1. The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.
   2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3. Both refrigerant lines shall be insulated from the outdoor unit.
   4. Return air shall be through a resin net mold resistant filter.
   5. The indoor units shall be equipped with a condensate pan.
   6. The indoor units shall be equipped with a return air thermistor.
   7. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin intelligent Touch advanced multi-zone controller or an intelligent Manager III customizable BMS. Consult with Daikin prior to applying controls.

I. Optional Accessories Available:
1. Remote “in-room” sensor kit KRCS01-1B.
2. A condensate pump (DACA-CP1-1).

2.3 BRANCH SELECTOR (BS) BOX FOR VRV HEAT RECOVERY SYSTEM

A. General: The BS boxes are designed specifically for use with the manufacturer’s VRV heat recovery system components.
1. These selector boxes shall be factory assembled, wired, and piped.
2. These selector boxes must be run tested at the factory.

3. These selector boxes must be mounted indoors.
4. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

B. Unit Components:
1. These units shall have a galvanized steel plate casing.
2. The BS box shall consist of three electronic expansion valves (EEVs) that are serviceable and replaceable without opening the refrigeration system. If the manufacturer employs any solenoid valves in lieu of EEVs pressure-rated shutoff isolation valves shall be provided and installed by contractor upstream and downstream of the BS box to facilitate serviceability without opening the refrigeration system. In addition, additional sound attenuation measures must be taken and provided at no additional cost to owner to ensure sound requirement listed below is met.
3. In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundant valves must be provided.
4. The cabinet shall contain a subcooling heat exchanger.
5. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.
6. Nominal sound pressure levels shall not exceed 44 dB (A) while operating and 48 dB (A) max. Any alternate units not meeting this sound requirement shall be provided with additional attenuation (with means of servicing branch selector box), to meet sound levels of this paragraph.

C. Condensate Removal:
1. The unit shall not require provisions for condensate removal. If a different vendor than Basis of Design is selected by the contractor, contractor shall be responsible for all additional engineering design costs and costs of addition condensate drain work.

D. Electrical:
1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
3. The minimum circuit amps (MCA) shall be 0.1 and the maximum overcurrent protection amps (MOP) shall be 15.
4. The control voltage between the indoor and outdoor unit shall be 18VDC non-shielded, stranded 2 conductor cable.

2.4 ADVANCED MULTI-ZONE CONTROLLERS

A. The Daikin AC VRV advanced multi-zone controllers are compatible with all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. The advanced multi-zone controller wiring consist of a non-polar two-wire connection to the outdoor unit. The advanced multi-zone controllers may be wall-mounted and can be adjusted to maintain the optimal operation of up to 64 connected indoor unit groups and 128 indoor units. Set temperatures can be adjusted in increments of 1°F. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address.

B. DCM601A71: INTELLIGENT TOUCH MANAGER (iTM) V.1.02
1. The intelligent Touch Manager (version 1.02) shall provide control for all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be

capable of controlling a maximum or 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The intelligent Touch Manager shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

a. Up to 7 iTM Plus Adapters can be connected to a single intelligent Touch Manager. This combination will provide intelligent Touch Manager monitoring and control of up to 512 indoor unit groups, 1024 indoor units, and 80 outdoor units

2. The controller wiring shall consist of a non-polar two-wire connection to the indoor unit at terminals F1F2 (out-out) of the outdoor unit.
3. Provide Trend Logging. Indoor unit, outdoor unit and connected external components operation data shall be stored in the iTM every minute for the previous 5 days. The operation data can be accessed and downloaded through the iTM web access or USB. Include the following data:
    a. Indoor and outdoor unit* operation data
    b. BACnet® client management data points (AI, AO, AV, BI, BO, BV, MI, MO and MV)
    c. WAGO® IO system data points (External DI, DIO, PI AI and AO)
4. The intelligent Touch Manager can be used in conjunction with the BRC1E71 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet, and Lonworks interfaces to control the same indoor unit groups. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each remote controller group associated with the intelligent Touch Manager. DIII-NET address can be set for one (1) indoor unit or each indoor unit in the remote controller group. No more than 2 remote controllers can be placed in the same group.
5. Provide two RJ-45 Ethernet ports to support interconnection with a network PC via the Internet, Local Area Network (LAN), or connection with a non-networked PC after completed installation.
6. Web access functions shall be available so that facility staff can securely log into each Intelligent Touch Manager via the PC's web browser to support monitoring, scheduling, error email, and general user functions. Additional optional software functions of Power Proportional Distribution tenant billing and Energy Navigator shall also be available. The optional software shall require advanced purchase and can only be activated upon receipt of a license activation key from Daikin AC.
    a. Mounting: The intelligent Touch Manager shall be mounted on the wall or into the mounting fixtures included with the intelligent Touch Manager.
    b. Display Features:
        1) The intelligent Touch Manager shall be approximately 11.42" x 9.57" x 1.97' in size with a backlit 10.4" LCD display.
        2) Display information shall be selectable from English, French, Italian, Korean, Dutch, Portuguese, Chinese, Japanese, German, or Spanish.
        3) Featured backlit LCD with auto off after 30 minutes (default) is adjustable between 1 to 60 minutes, or the choice of 3 different screen savers.
        4) Area and Group configuration
            a) Area contains one (1) or more Area(s) or Group(s)
            b) A Group may be an indoor unit, Di, Dio point that has a DIII-NET address
        5) An Area is a tiered group where management points (indoor unit, digital

input/output, and analog input groups) can be monitored and controlled by global settings. Up to 650 Areas can be created. Area hierarchy can have up to 10 tiered levels (ex. top level: 1st floor West, 2nd level: offices, hallways, 3rd level: Office 101, 102, and 103, etc.). Area configuration shall classify levels of monitoring and control for each management point

a) Areas and Groups may be assigned names (ex. Office 101, Lobby, North Hallway, etc.)

6) The Controller shall display On/Off, Operation Mode, Setpoint, Space Temperature, Louver Position, Fan Speed for each Area or Group.
7) The Controller shall display Date (mm/dd/yyyy, yyyy/mm/dd, or dd/mm/yyyy format selectable) and day of the week along with the time of day (12hr or 24hr display selectable).
8) The Controller shall adjust for daylight savings time (DST) automatically.
9) Display information shall be updated every 3 seconds to show the latest status of the indoor unit groups.
10) System status icons shall display On/Off (color coded), Malfunction/Error (color coded), Forced Stop, Setback, Filter, Maintenance, and Screen Lock.
11) The controller shall display the temperature setpoint in one degree increments with a range of 60oF – 90oF, 1oF basis (16oC – 32oC, 0.1oC basis).
    a) Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius.
12) Display shall reflect room temperature -58oF – 248oF, 1oF basis (-50oC – 120oC, 0.1oC basis) range in one degree increment.
    a) Display of room temperature information shall be configurable for Fahrenheit or Celsius
13) The Menu List shall be used to configure options and display information for each Area or Group.
14) Error status shall be displayed in the event of system abnormality/error with one of three color coded icons placed over the indoor unit icon or lower task bar.
    a) System errors are generated when the intelligent Touch Manager system with other VRV controls systems combined or power proportional distribution calculation errors occur. The intelligent Touch Manager shall display the error with a red triangle placed on the lower task bar
    b) Unit errors occurring within the VRV system shall be displayed with a yellow triangle placed over the indoor unit icon
    c) Limit errors are based upon preconfigured analog input upper and lower limit settings and are generated when the limits have been met. When limit error is generated a yellow triangle will be placed over the unit icon.
    d) Communication errors between the intelligent Touch Manager and the indoor units shall be displayed with a blue triangle placed over the indoor unit icon
    e) Error history shall be available for viewing for up to 500,000 errors/abnormality events
15) Floor plan layout
    a) Capable of displaying site floor plan as the background for visual navigation. Indoor unit, DIII-NET Di and Dio, and External Di, DO, and Ai icons with operational status can be placed on the floor layout

Up to 4 status points can be assigned to the indoor unit icon (room name, room temperature, setpoint, and mode)
Digital input and output icons will display On/Off status
Analog input icons will display analog value
Up to 60 floor layout sections can be created

c. Basic Operation:
   1) Capable of controlling by Area(s) or Group(s)
   2) Controller shall control the following group operations:
      a) On/Off
      b) Operation Mode (Cool, Heat, Fan, Dry, and Auto)
      c) Setpoint for current mode in the occupied period
      d) Controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating based upon the Area or Group configurations
      e) Relative Setup (Cooling) and Setback (Heating) setpoints in the unoccupied mode adjustable to 2 - 120F (1 - 70C).
         The high and low relative setback setpoints.
         Setup and Setback setpoints can be set inside or outside of the occupied setpoint range.
         The recovery differential shall be 40F (default) and adjustable between 2 – 100F.
         Settings shall be applied based upon the Area or Group configurations.
      f) Fan Speed
         Up to 3 speeds (dependent upon indoor unit type)
      g) Louver direction (dependent upon indoor unit type)
         5 fixed positions or swing position
      h) Remote controller permit/prohibit of On/Off, Mode, and Setpoint
      i) Lock out setting for Intelligent Touch Manager display
      j) Indoor unit Group/Area assignment
   3) Capable of providing battery backup power for the clock at least 1 year when no AC power is applied.
      a) The battery can last at least 13 years when AC power is applied
      b) Settings stored in non-volatile memory

d. Programmability:
   1) Controller shall support weekly schedule settings.
      a) 7 day weekly pattern
      b) The schedule shall have the capabilities of being enabled or disabled
      c) 100 independent schedules configurable with up to 20 events settable for each days schedule
         Each scheduled event shall specify time and target Area or Group.
         Each scheduled event shall include On/Off, Operation Mode, Occupied Setpoint, Pre-Cool, Pre-Heat, Setback High, Setback Low, Remote Controller On/Off Prohibit, Remote Controller Mode Prohibit, Remote Controller Setpoint Prohibit, Timer Extension Setting, Fan Speed, and Setpoint Range Limit
         Setpoint when unit is On (occupied)
         Configurable Setup (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied).Time setting in 1-minute increments. Timer Extension

shall be used for a timed override (settable from 30 – 180 minutes) to allow indoor unit operation during the unoccupied period

d) A maximum of 40 exception days can be schedule on the yearly schedule (repeats yearly). Exception days shall be used to override specified days on the weekly schedule based upon irregular occupied/unoccupied conditions .Exception days can be configured on a set date (Jan 1) or floating date (1st Monday in September)

2) Controller shall support auto-changeover.

a) Auto-change shall provide Fixed, Operating, and Averaging changeover methods for both Heat Pump and Heat Recovery systems based upon the changeover group configuration. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint. When selecting the Auto-changeover method the Differential should also be set (default value 4oF, adjustable between 0 – 13oF). The (Thermal) Differential is the tolerance for the indoor unit's setpoint. When the difference between the representative room temperature and the representative indoor unit setpoint exceed the thermal differential, the operation mode is changed. When the mode is changed from Cool to Heat the setpoint will be decreased by the thermal differential set in the Auto Changeover configuration (ex. If the mode is Cool with a 74oF setpoint and a changeover differential of 4oF, when switched from Cool to Heat the new setpoint for heating will be 70oF). When the mode is changed from Heat to Cool the setpoint will be increased by the thermal differential set in the Auto Changeover configuration (ex. If the mode is Heat with a 72oF setpoint and a changeover differential of 4oF, when switched from Heat to Cool the new setpoint for cooling will be 76oF).

b) Fixed method

Changeover evaluated by room temperature and setpoint of the representative indoor unit (first registered indoor unit in group) in the changeover group even when it is not operating (must be in Cool, Heat, or Auto mode)

c) Operating method

Changeover evaluated by searching for an indoor unit group that is operating in Cool, Heat, or Auto mode and uses the indoor unit room temperature and setpoint as the representative room temperature and setpoint . The order of the search is based upon the order each indoor unit group is assigned to the intelligent Touch Manager within the changeover group. If none of the indoor units in the group meet the above requirements the Fixed method of changeover will be applied

d) Average method

Changeover evaluated by the average of all indoor unit group's room temperatures and setpoints operating in Cool, Heat, or Auto mode in the changeover group list.

If none of the indoor units in the group meet the above requirements the Fixed method of changeover will be applied. If the average room temperature ≤ average setpoint, the indoor units will be placed in Heat

mode. If the average room temperature ≥ average setpoint, the indoor units will be placed in Cool mode

e) Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained to the same outdoor unit in the Heat Pump system or branch selector box in the Heat Recovery system.

f) Changeover from heat to cool mode shall occur when the room temperature is great than or equal to the heating setpoint, plus the setting of the thermal difference (0 – 13oF) with a safety allowance if necessary is established

g) Changeover from cool to heating mode shall occur when room temperature is less than or equal to the cooling setpoint, minus the setting of the thermal difference (0 – 13oF) with a safety allowance if necessary is established

h) 30 minute guard timer
Upon changeover, guard timer will prevent another changeover during this period. Guard timer is ignored by a change of setpoint manually from either intelligent Touch Manger or Remote Controller or by schedule.

3) Controller shall support Interlock

a) Interlock feature for use with 3rd party equipment (DOAS, dampers, occupancy sensing, etc…) to automatically control Groups or Areas corresponding to the change of the operation states or the On/Off states of any Group.

b) WAGO I/O unit – Di, Do, Ai
On/Off based monitoring and control of equipment
Manual or scheduled operation of equipment
Operation based upon interlock with VRV indoor unit group(s)
Monitor equipment error/alarm status

c) Digital Input/Output (DEC102A51-US2) unit or Digital Input (DEC101A51-US2) unit
On/Off based monitoring and control of equipment
Manual or scheduled operation of equipment
Operation based upon interlock with VRV indoor unit group(s)
Monitor equipment error/alarm status

4) Controller shall support force shutdown of associated indoor unit groups.

e. Web/Email Function

1) Each intelligent Touch Manager shall be capable of monitoring, operating, and scheduling a maximum of 64 indoor unit groups (up to 512 indoor unit groups with the addition of the iTM Plus Adapter) from a networked PC's web browser. It shall also be capable of creating general user access and sending detailed error emails to a customized distribution list (up to 10 email addresses).

2) All PCs shall be field supplied

D. Optional Software (Licensed per option, per intelligent Touch Manager shall be required.)

a. Power Proportional Distribution (PPD): The tenant billing option shall be capable of calculating VRV Controls Network equipment energy usage in kWh based on the energy

consumption of the outdoor unit(s) divided among the associated indoor units. This software is used in conjunction with the intelligent Touch Manager and a Watt Hour Meter (WHM). A maximum of 3 Watt Hour Meters can be connected to the intelligent Touch Manager. Up to 4 additional Watt Hour Meters can be connected to each iTM Plus Adapter, and up to 7 iTM Plus Adapters can be connected to the intelligent Touch Manager. The Power Proportional Distribution results data can be saved to a USB flash drive, or on a PC with the use of the web access. Data is saved in the CSV format. Results can be stored up to 13 months in the intelligent Touch Manager.

b. DCM009A51: BACnet Client Option

1) The BACnet Client Option shall be capable of making the VRV Supervisory Controller work as a BACnet client using the BACnet/IP protocol. A BACnet client machine is able to send service requests to a BACnet server machine that then performs the services and reports the results to the client. By registering equipment and sensors connected to a BACnet server as management points, equipment and sensors can be monitored and controlled by the VRV Supervisory Controller. The BACnet Client option must be enabled/ activated in each VRV Supervisory Controller to be used.

2) System Capacity

i) A maximum of 50 BACnet servers can be monitored and/or controlled by one VRV Supervisory Controller.

ii) A maximum of 1536 objects can be monitored and/or controlled by one VRV Supervisory Controller.

iii) A maximum of 512 management points, including BACnet management points, external management points, internal Ai management points, AHU management points, and Chiller management points, can be registered in one VRV Supervisory Controller.

3) Objects that can be used in BACnet management points are:

i) Analog Input (Object Type Number 0)

ii) Analog Output (Object Type Number 1)

iii) Analog Value (Object Type Number 2)

iv) Binary Input (Object Type Number 3)

v) Binary Output (Object Type Number 4)

vi) Binary Value (Object Type Number 5)

vii) Multi-Sate Input (Object Type Number 13)

viii) Multi-Sate Output (Object Type Number 14)

ix) Multi-Sate Value (Object Type Number 19)

c. DCM014A51: BACnet Server Gateway Option

1) The iTM BACnet Server Gateway Option shall be capable of making the VRV Supervisory Controller work as a BACnet gateway using the BACnet/IP protocol. The iTM BACnet Server Gateway Option shall be capable of exposing indoor unit management points as BACnet objects to the (BMS). The iTM BACnet Server/Gateway Option shall be capable of allowing the BMS to monitor and control indoor units BACnet objects.

2) The iTM BACnet Server Gateway Option shall be compatible with VRV, SkyAir, Outdoor Air Processing Unit, Mini-Split system with use of KRP928, and FFQ indoor unit for Multi-split system.

3) Functions:

i. The iTM BACnet Server Gateway Option shall be capable of supporting Change of Value (COV) notification.
ii. The iTM BACnet Server Gateway Option shall communicate to BMS using port number 47808 (configurable).
iii. The iTM BACnet Server Gateway Option shall function as BACnet router to provide unique virtual BACnet device identification number (ID) for every indoor unit group address.
iv. The iTM BACnet Server Gateway Option shall provide configurable BACnet Network number.
v. The iTM BACnet Server Gateway Option shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.
vi. The iTM BACnet Server Gateway Option shall be run in environments with BACnet communication traffic up to 100 packets/second.
vii. The iTM BACnet Server Gateway Option functions shall be configurable through CSV file which shall be downloaded from iTM and configured by trained personnel.

4) System Capacity
i. Max of 128 indoor units groups (Up to 256 indoor units) can be controlled from (BMS)
ii. Max of 8 DIII-Net ports shall be connected to iTM.

5) The Building Management System shall monitor and control the following BACnet objects for indoor units
i. Indoor unit ON/OFF status.
ii. Alarm status with error description
iii. Room temperature.
iv. Indoor Unit ON details
- Off
- Normal [ON]
- Override
- Setback

v. Filter sign status.
vi. Fan status.
vii. Communication status.
viii. Thermo-on status.
ix. Compressor status
- On
- Off
- Defrost

x. Aux heater status.
xi. Occupancy Mode
- Unoccupied,
- Occupied
- Standby

xii. Operation Mode (Cool, Heat, Fan, and Dry)
xiii. Cooling and Heating setpoints during occupied mode.
xiv. Cooling and Heating setpoints during unoccupied mode.
xv. Maximum and minimum cooling setpoint.

xvi. Maximum and Minimum heating setpoint
xvii. Minimum cooling and heating setpoint differential.
xviii. Fan Speed
- Up to 3 speeds (dependent upon indoor unit type)

xix. Vane direction (dependent upon indoor unit type)
- 5 fixed positions or swing position

xx. Remote controller permit/prohibit
- On/Off
- Mode,
- Setpoint

xxi. Filter sign reset for indoor units
xxii. Forced indoor units off.

6) The Building Management System may choose to monitor and control the following BACnet objects linked to iTM control logic:
   i. Enable/Disable iTM Schedule operation.
   ii. Enable/Disable iTM Auto Changeover Operation.
   iii. Set Timed Override Minutes.
   - Monitor and configure timer extension on iTM (30, 60, 90, 120, 150, 180 minutes)

   iv. System forced off
   - Enable/Disable all emergency stop programs that are registered on the iTM.

7) Schedule: The BMS shall utilize iTM schedule function or support weekly schedule settings through its programming.
   i. BMS schedule shall support the indoor unit:
   - Each scheduled event shall specify time and target group address.
   - Each scheduled event shall include Occupancy Mode, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied cooling setpoint, Unoccupied heating setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable.
   - An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BMS programming.

8) Auto Changeover The BMS shall utilize iTM Auto changeover function or support auto-changeover through its programming.
   i. Auto-change shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
   ii. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.
   iii. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint

- Differential to be determined by BACnet building management system programming

iv. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint.
- Differential to be determined by BACnet building management system programming

v. Guard timer
- Upon changeover, guard timer will prevent another changeover during this period.
- Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule.
- Guard timer to be configured by BMS programming (30 minute minimum recommended)

9) Setpoint limitation The BMS shall utilize maximum and minimum cooling and heating setpoint to configure upper and lower setpoints range.

10) System shutdown: BMS should utilize System forced off point to execute emergency stop program registered on the iTM.

11) Restricted functions: The following iTM functions shall be prohibited when the BACnet Server Gateway option enabled:

i. Interlocking Control.
ii. Emergency Stop (Emergency stop manual release).
iii. Power Proportional Distribution (PPD) option.
iv. BACnet Client option.
v. D-Net Service.
vi. External Management Point Registration

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install units level and plumb.
B. Install indoor components using manufacturer's standard mounting devices securely fastened to building structure.
C. Install each unit and serviceable devices and components easily accessible for service.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system with nitrogen and pressure test at 100 psi for leaks. Repair leaks and retest until no leaks exist. Once leaks are stopped charge with refrigerate.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.03 STARTUP SERVICE

Start-up and service shall be completed by the authorized manufacturer's representative.

A. Startup

a. At a minimum, the following procedures shall occur during the start-up of each system;
   i. Service Company representative shall make onsite visit of each system being installed during the installation
   ii. Service Company representative shall witness contractor's pressure test of each system being installed
   iii. Service Company representative shall witness contractor's evacuation test of each system being installed
   iv. Service Company representative shall initialize and startup system. The contractor will be required to provide sufficient refrigerant for each system to be fully charged. Estimated required amount of refrigerant can be obtained by contacting the manufacturer's representative

B. Service

a. In addition to specified warranty period, contactor shall engage Service Company to provide a minimum of four (4) maintenance inspections of the equipment during a one year period that shall begin at completion of startup of the equipment.

The scope of these maintenance inspections shall include:

b. Check in with owner's representative and review system operation
c. Check centralized controller for alarms
d. Replacement of disposable filters (filters provided by others)
e. Clean all permanent air filters
f. Record and Review one hour of operating data per system using manufactures service tool
g. Clean drain pan and condensate pumps on fan coil units
h. Check and tighten electrical connections
i. Review control settings and programming
j. Visually inspect all equipment for damage
k. Clean condenser coil as needed
l. Inspect visible refrigerant piping insulation
m. Inspect for visible refrigerant leaks
n. Inspect and clean PCB or Inverter boards

3.04 TRAINING AND SERVICE REQUIREMENTS

DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative for two four (4) hour training sessions (separate days) to train the owner's and any maintenance personnel to adjust, operate, and maintain units.

COMMISSIONING

A. Service company shall include 8hrs of post start-up commissioning labor per VRF system. This will be used to meet with occupants and set up each living space, adjust master controller settings and add controller faceplates as requested.

B. Responsibility: Commissioning will include VRV startup and controls coordinated through the mechanical contractor. Mechanical contractor will be responsible for coordinating the commissioning once the system has been started.

SERVICE AGREEMENT

A. The equipment manufacturer shall include in their bid a 5-year full-service maintenance agreement which shall include the specified remote monitoring and diagnosis of the systems, annual condensing coil cleaning, quarterly system run checks and is to include all regularly scheduled system maintenance. Filter changing is not included in the agreement.

B. VRV REMOTE MONITORING

1. Service Company will provide for a period of five years from startup date remote monitoring service of VRV system (owner must supply static IP address and necessary hardware for internet connectivity) to include:
   i. Malfunction and predictive monitoring with notification direct to Service Company
   ii. Troubleshooting report with 30 minutes of data prior to the notification.
   iii. Priority technical support through 24/7 technical support.
   iv. Quarterly reports
      1. Equipment Listing
      2. Error History
      3. Graphed Power Consumption
      4. Operational Data
      5. Trended running time of parts, including Compressors, IDU fan and ODU fan motors.
   v. Customer Dashboard View with VRV Cloud access
   vi. Technical View with technical parameter monitoring

END OF SECTION 238200

SECTION 238300 - UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
2. Propeller unit heaters with electric-resistance heating coils.
3. Wall heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Comply with Division 01 section “Submittals Procedures”.
B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

D. Field quality-control test reports.
E. Operation and maintenance data.
F. Sustainable Design Submittals:

1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2007, Section 5 – “Systems and Equipment.”

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain unit heaters, components, devices, and other associated accessories through one source from single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
D. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.4 EXTRA MATERIALS

A. Refer to Division 01 Section “Extra Materials” for requirements.
B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane.
2. Indeeco.
3. Carrier Corporation.
4. Markel Products; a division of TPI Corporation.
5. QMark Electric Heating; a division of Marley Engineered Products.

B. Description: A factory-assembled and -tested unit complying with ARI 440.

1. Comply with UL 2021.

C. Coil Section Insulation: Glass-fiber insulation; surfaces exposed to airstream shall be aluminum-foil facing to prevent erosion of glass fibers.

1. Thickness: 1 inch
2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

D. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.

1. Vertical Unit, Exposed Front Panels: Minimum 0.0677-inch- thick, galvanized, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.

a. Provide recessed models where indicated.
b. Coordinate exact dimensions with other trades for exact rough-in dimensions.

2. Horizontal Unit, Ducted with Concealed Bottom Panels: Minimum 0.0677-inch-thick, galvanized, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.

a. Duct supply and provide lined plenum with open end duct with screen mesh above ceiling for return air.

3. Recessing Flanges: Steel, finished to match cabinet.
4. Control Access Door: Key operated.
5. Base: Minimum 0.0528-inch- thick steel, finished to match cabinet, 6 inches high with leveling bolts.

E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: 90 percent arrestance and 8 MERV.

F. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

G. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23, Section "Common Motor Requirements for HVAC Equipment."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

H. DDC Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods output from EMS.
2. Unoccupied Period Override: Scheduled number of hours based on EMS zone.
3. Unit Supply-Air Fan Operations:

a. Occupied Periods (when OAT < 50 degrees F (adj.)): Fan runs continuously.
b. Unoccupied Periods: Fan cycles to maintain setback room temperature.

4. Heating Coil Operations:

a. Occupied Periods: Energize stages of electric resistance heat in sequence to maintain temperature setpoint. Provide heating if room temperature falls below thermostat set point.
b. Unoccupied Periods: Start fan and energize stages of electric-resistance heat in sequence to maintain temperature setpoint. Provide heating if room temperature falls below setback temperature.

5. Controller shall have volatile-memory backup.

I. Electrical Connection: Factory wire motors and controls for a single field connection.

1. Provide factory installed fused disconnect switches.

J. Capacities and Characteristics:

1. Cabinet:

a. Vertical, Fully Recessed: Upflow

1) Air Inlet and Outlet: Front, punched louver inlet and punched louver outlet.

b. Horizontal, Fully Recessed:

1) Air Inlet and Outlet: Front, punched louver inlet and punched louver outlet.
2) Air Inlet: Bottom, punched louver.

3) Air Outlet: Bottom, punched louver.

2. Fan:

a. Airflow: Refer to schedule on plans.
b. External Static Pressure: 0.0 inches wg.
c. Fan Speed: Refer to schedule on plans.
d. Motor Horsepower: Refer to schedule on plans.

3. Heating Capacity:

a. Output: Refer to schedule on plans.
b. Entering-Air Temperature: Refer to schedule on plans.
c. Air-Temperature Rise: Refer to schedule on plans.

4. Electric-Resistance Heating Coil:

a. Capacity: Refer to schedule on plans.
b. Number of Steps: Refer to schedule on plans.

5. Filters:

a. Efficiency: MERV 8.
b. Thickness: 1 inch

6. Electrical Characteristics for Single-Point Connection:

a. Volts: Refer to schedule on plans.
b. Phase: Refer to schedule on plans.
c. Hertz: Refer to schedule on plans.
d. Full-Load Amperes: Refer to schedule on plans.
e. Minimum Circuit Ampacity: Refer to schedule on plans.
f. Maximum Overcurrent Protection: Refer to schedule on plans.

2.2 PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Markel Products.
2. Indeeco.
3. Carrier Corporation.
4. Trane.
5. QMark Electric Heating; a division of Marley Engineered Products.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
C. Comply with UL 2021.
D. Cabinet: Removable panels for maintenance access to controls.
E. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
G. Discharge Louver: Adjustable fin diffuser for horizontal units.

H. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

I. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

J. Fan Motors: Comply with requirements in"" Division 23, Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated.

K. Control Devices: Wall-mounting thermostat.

L. Capacities and Characteristics:

1. Heating Capacity:

a. Heat Output: Refer to schedule on plans.
b. Mounting Height: Coordinate with the actual specs.

2. Electric Coil:

a. Heating Capacity: Refer to schedule on plans.
b. Number of Steps: Refer to schedule on plans.

3. Supply Air:

a. Airflow: Refer to schedule on plans.
b. Leaving-Air Temperature: Refer to schedule on plans.
c. Entering-Air Temperature: Refer to schedule on plans.

4. Fan Motor:

a. High Speed: Refer to schedule on plans.
b. Motor Size: Refer to schedule on plans.

5. Electrical Characteristics for Single-Point Connection:

a. Volts/Phase/Hertz: Refer to schedule on plans.
b. Full-Load Amperes: Refer to schedule on plans.
c. Minimum Circuit Amperes: Refer to schedule on plans.
d. Maximum Overcurrent Protection: Refer to schedule on plans.
e. Provide with factory installed integral fused disconnect switch.

2.3 WALL HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Markel Products.
2. Indeeco.
3. Carrier Corporation.

4. Trane.
5. QMark Electric Heating.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:

1. Front Panel: Extruded-aluminum bar grille with removable panels fastened with tamperproof fasteners.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

D. Recessed-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

F. Fan: Aluminum propeller directly connected to motor.

1. Motor: Permanently lubricated. Comply with requirements in Division 23, Section "Common Motor Requirements for HVAC Equipment."

G. Controls: Unit-mounted thermostat.

H. Electrical Connection: Factory wire motors and controls for a single field connection.

1. Provide with factory installed integral fused disconnect switch.

I. Capacities and Characteristics: Refer to schedule on drawings.

1. Airflow: Refer to schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Division 23, Section "Sound and Vibration Controls for HVAC Piping and Equipment."

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers or spring hangers. Hanger rods and attachments to structure are specified in Division 23, Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23, Section "Sound and Vibration Controls for HVAC Piping and Equipment."

D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of unit heater.
F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.
G. Piping installation requirements are specified in other Division 23, Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
H. Install piping adjacent to machine to allow service and maintenance.
I. Comply with safety requirements in UL 1995.
J. Ground equipment according to Division 26, Section "Grounding and Bonding for Electrical Systems."
K. Connect wiring according to Division 26, Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.3 DEMONSTRATION

A. Refer to Division 01 Section, “Demonstration & Training” for requirements.
B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain makeup-air units.

1. Video record training sessions.
2. Instructor shall be factory trained and certified.
3. Provide not less than 4 hours of training.
4. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.
5. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
6. Obtain Owner sign-off that training is complete.
7. Owner training shall be held at Project site.

END OF SECTION 238300

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SECTION 250100 - MOTOR STARTERS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

1. MOTOR STARTERS-GENERAL

   A. Where motor starters are required for mechanical equipment, they are to be the responsibility of the Contractor furnishing the equipment as outlined herein.

   B. Motor starters shall be furnished by the Equipment Supplier with his equipment. Coordinate all requirements for starters with equipment suppliers and other trades.

   C. Motor starters shall be NEMA style. I.E.C.-style starters are not to be provided. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.

   D. Unless otherwise noted, provide combination starter/disconnects for all equipment requiring a starter.

2. ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

   A. All mechanical equipment shall be provided for single point electrical connection unless specifically noted to the contrary. Refer to schedules and other sections of these specifications for further requirements. It is the responsibility of the Contractor to coordinate the electrical characteristics of all equipment with the electrical provisions indicated on the Contract Documents. The Contractor shall notify the Engineer in writing ten calendar days prior to bid of any discrepancy so a written clarification by Addendum may be made. If such notice is not given, the Contractor shall be responsible for any and all costs or delays associated with any changes required. Specification of equipment characteristics made during review of shop drawings shall not relieve the Contractor of this responsibility.

   B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, and other applicable sections of the N.E.C.

   C. It is the Contractor's responsibility to furnish and install fusible or non-fusible disconnect switches or circuit breakers for disconnecting means as required by the Code for all electrically powered equipment. All power wiring from source, thru disconnecting means and motor starters to motor terminals or equipment junction box is to be furnished and installed by the Contractor. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per code requirements. Unless otherwise notes, provide combination starter/disconnects for all equipment requiring a starter.

   D. Final electrical connection of equipment shall be verified for proper voltage requirements in conjunction with the motor nameplate patch and actual wiring configuration. Any costs associated

with damage to appliances motors, equipment, etc., connected to incorrect supply voltage shall be borne by the Contractor.

E. Refrigeration condensing units with internal compressors shall be furnished with integral starter. The Contractor is to furnish and install a fusible disconnecting mains with fuses sized to motor nameplate requirements. Coordinate wiring, mounting and style of disconnect switch at unit in field.

F. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of the Contractor.

G. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

H. Observe the following standards for manufacturers of equipment and selection of components.

(1) Starters, control devices and assemblies: NEMA, U.L. - (I.E.C. style not acceptable)

(2) Enclosures for electrical equipment: NEMA, U.L.

(3) Enclosed switches: NEMA, U.L.

(4) All electrical work, generally: National Electrical Code

(5) All electrical work in industrial occupancies: J.I.C. standards

(6) All electrical components and materials: U.L. listing required.

I. Where required, the Contractor is to provide mounting rails or channels to install starters with code-required clearances. Framing shall be solidly anchored by welding expansion shields in masonry or other approved anchorage. Frames are to be constructed of steel angles or pre-manufactured channel systems such as Unistrut, Kindorf or B-Line Company. Framing material shall be pre-finished with corrosion-resistant material or painted with two coats corrosion-resistant oil-based enamel.

3. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 1/2 H.P OR LESS

A. This section describes requirements for small mechanical equipment such as (but not limited to) package terminal heating/cooling units, (water source heat pumps, etc.) VAV boxes, unit heaters, vertical and horizontal unit ventilators, exhaust fans, in-line fans, fan coil units, cabinet heaters and the like.

B. Small equipment with motor(s) of 1/2 H.P., single phase or less are generally not required to be furnished with NEMA-style starter(s), unless otherwise noted.

C. For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment, suitable for the service duty.

D. Provide transformer within unit as required to derive low voltage A.C. for thermostat control or derive from temperature controls panel, if available.

E. Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder. See also Article 2-B, this Section.

F. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction. Refer to mechanical equipment schedules for further information.

G. Where fractional horsepower duplex pumps such as water circulators, sump pumps, etc. are provided, they shall be provided with alternators, cordsets, etc., as required for a complete installation.

4. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 3/4 H.P. OR LARGER

A. This section describes requirements for mechanical equipment such as (but not limited to) exhaust fans, larger air handling units, cooling tower fans, water source heat pumps, chilled or hot water pumps, D.X. roof-top units, air compressors and the like.

B. Provide premium efficiency motors.

C. Equipment provided with motor(s) of 3/4 H.P. and larger, single or three-phase are required to be furnished with starters suitable for the load(s) specified. It is recommended that starters be furnished integrally with or mounted on equipment for field wiring by the Contractor. Where starters are furnished separate from equipment, furnish templates or rough-in diagrams to the appropriate contractor for his use in installation.

D. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall provide starters capable of limiting inrush currents. These shall be of the wye-delta, reduced voltage open-transition type, or electronic controlled, as required. Do not utilize closed transition starters unless specifically indicated.

E. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.

(1) Contacts shall be silver-alloy, double-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.

(2) Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, rated for continuous duty. Provide coil clearing contact as required.

(3) Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.

(4) Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated on plans or schedules for automatic control. Provide a green run pilot light.

(5) Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push button or similar means. Class 10 or Class 30 overloads may be used, depending on the type of anticipated service.

(6) Provide at least one N.O. and one N.C. auxiliary contact (field-convertible to opposite operation) with each starter. Refer to mechanical details or schedules for additional requirements, if any. All starters shall have space for two additional single-pole contacts.

(7) All starters shall be thru-wiring type.

(8) Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 15 H.P. or larger.

(9) Provide power factor correction capacitors on motors of 15 H.P. or larger where predicted power factor based on manufacturer's data will fall below 0.90%. Capacitors shall be of the unit-cell type, in single enclosure with discharge resistors and tank overpressure circuit interrupter for safety.

5. REQUIREMENTS FOR WIRING

A. All wiring, including controls, interlock, miscellaneous power, sensors, thermostats, etc., shall be installed in metallic raceway systems that are in compliance with all Division 26 requirements of these Specifications, unless specifically noted otherwise. Open cabling systems will only be permitted where specifically permitted within the Division 26 Specifications and if less than 50 volts A.C. peak-to-peak or 50 volts maximum D.C.

B. Where open cabling is permitted, it shall be installed with proper support as specified in the Division 26 Specifications.

C. Where open cabling is permitted, and installed in environmental air plenum (return, relief, supply, etc.), the materials installed shall be in compliance with N.E.C. Articles 700, 725, 770 (for fiber optic), 780 and 800.

D. Where open cabling is permitted, it shall only be installed open in accessible spaces. Where concealed in walls, it shall be routed through raceways to outlet boxe(s) for the terminal device.

6. INVERTER DUTY MOTORS

A. Motors which are controlled by variable frequency drive shall be:

(1) NEMA MG-1 Part 31 rated for Inverter Duty.

(2) Furnished with shaft grounding kit for all motors:

a. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

b. Motors Pumps greater than 100 HP to 1000 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. Provide shaft grounding ring on drive end and non-drive end of motor per manufacturer's instructions. Additionally provide insulated bearing journals to further reduce risk of current dissipation through bearings. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

END OF SECTION 250100

SECTION 250200 - CONTROLS – DIRECT DIGITAL

1. GENERAL

A. The Contractor shall furnish all labor, materials, equipment and services required to provide a complete temperature control system as specified and as shown on the plans.

B. Prior to the installation of or payment for any work, the Contractor shall prepare submittals which shall be reviewed by the Architect and Engineer. These submittals shall include a complete control diagram and sequence of operation of the entire system, plus engineering data on all devices used.

C. The Contractor shall be a licensed installer of HVAC temperature controls by a national temperature controls manufacturer. Acceptable manufacturer shall match the existing DDC BAS control system installed at the school. The installer shall have 5 years experience and installed a minimum of 8 systems of similar size. Their offices shall be within 150 miles of the project site.

D. The system herein specified shall be free from defects in workmanship and material under normal use and service if, within twelve (12) months from the date of acceptance by the Engineer, any of the equipment herein described is proved to be defective in workmanship or material, it will be adjusted, repaired, or replaced free of charge by the Contractor.

E. All equipment, unless specified to the contrary, shall be fully proportioning and adjustable. The Control System shall consist of all room thermostats, air stream thermostats, valves, damper operators, relays, freeze protection equipment, dampers, panels, and other accessory equipment not provided with the equipment to fill the intent of the specifications and drawings.

F. Complete freeze protection equipment shall be provided at all required locations. Freeze protection thermostats shall have twenty-foot elements and be capable of de-energizing the circuit when any point along the element reaches the set point of the thermostat. Freezestat elements shall be placed on the leaving side of each heating coil, so that every square foot on the heating coil is protected. On heating coils larger than eighteen (18) square feet, provide multiple freezestats wired in series. The Contractor shall ensure that all freeze protection devices and equipment has been fully tested prior to the heating season and shall so certify in writing to the Engineers. The cost of replacement of equipment damaged by freeze-up caused by improper freeze protection or faulty control equipment shall be borne by the Contractor.

G. All units, controls, equipment, heat pumps, etc., and controls shall reset automatically when power is restored after an outage.

H. All control wiring concealed in walls and exposed in mechanical rooms, closets, etc., shall be in conduit. Provide plenum rated wiring where cable is concealed above ceilings. Do not paint wiring. The Contractor is responsible for protecting wiring from paint. Any painted cabling shall be replaced.

I. All dampers shall be capable of operating properly with the system pressures encountered. This shall include modulating and shut-off functions.

J. The Contractor shall also refer to the mechanical maintenance, HVAC equipment, and all other sections of the specifications for additional control requirements.

K. Provide smoke detectors and shut down control for all air handling units and combined air systems as required by the KBC and IMC Section 606.

L. All DDC controllers or control modules shall have covers to protect the circuit boards. All wiring shall be anchored securely within 6" of the controller.

M. Provide all control dampers, etc. not supplied with the equipment or required to accomplish the sequences specified.

N. The Contractor shall provide all refrigeration control and interlock wiring as recommended by the equipment manufacturer.

O. Wiring and required conduit in connection with the control system(s), including power wiring of any voltage, shall be installed by the Contractor. The Contractor may, at his option, engage the Electrical Contractor to accomplish this work. It is emphasized however, that the Contractor is finally responsible for all such work.

P. Electric power for the control panels, modules, unit controller, damper motors, etc., shall be derived from the building electric system. Power shall not be derived from the HVAC equipment power source or equipment low voltage transformers (internal or integral).

Q. The electrical work required for the installation of the control system(s), shall be provided by the Contractor in accordance with all National and Local Electrical Codes. All wiring shall be concealed except in Mechanical Rooms. All electrical work specified under this division of the specifications shall also comply with Division 26 of these specifications.

R. All exterior electrical work, equipment, etc. shall be waterproofed.

S. Controls system and all related components shall comply with ASHRAE Standard 135 (BACnet protocol).

2. OWNER'S TRAINING

A. The Contractor shall provide full instructions to designated personnel in the operation, maintenance, and programming of the system. The training shall be specifically oriented to the system and interfacing equipment installed. Four hours of Owner Training shall be provided at substantial completion, again after 6 months and again 1 year after substantial completion. The Owner Training shall include an overview of the entire HVAC system operation, temperature sensor setpoint manipulation, critical alarm training and graphics display overview. Subcontractors shall be present during Owner training sessions.

B. The Contractor shall provide a Sign-in Sheet and Meeting Minutes of the training. The Contractor shall also video record the initial training sessions. Complete Operations and Maintenance Manuals shall be reviewed by the Contractor during training.

3. CONTROL SYSTEM CHECKOUT AND TESTING – BY CONTROLS CONTRACTOR PRIOR TO DEMONSTRATION AND ACCEPTANCE

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any of all startup testing.

(1) Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 250200.
(2) Verify that control wiring is properly connected and free of shorts and ground faults.
(3) Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
(4) Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
(5) Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
(6) Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated. Submit log to Engineer for review.
(7) Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
(8) Alarms and Interlocks.
a. Check each alarm with an appropriate signal at a value that will trip the alarm.
b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

4. EQUIPMENT

A. CONTROL PANEL(S)

(1) Each system shall be provided with a local panel for mounting of all relays, switches, controllers, and thermometers associated with that system. Where one cabinet will not accommodate all the equipment necessary for one system, a second cabinet shall be mounted and bolted adjacent to it. Cabinets shall be provided with a 2/3's door. All devices shall be provided with lamacoid plastic nameplates for identification.

B. THERMOSTATS

(1) General

a. All thermostats shall have a "warmer-cooler" knob. This control shall allow the space occupants to reset the temperature up or down a predetermined amount. This amount, or no amount at all, shall be settable thru the BAS.

b. The thermostat shall have an unoccupied override button and an integral communications port.

c. The thermostat shall have no integral thermometer.

d. All thermostats provided for the project shall be similar in size and appearance.

e. Provide tamper-proof guards for all wall mounted thermostats selected by Owner.

f. All thermostats shall be mounted on a plastic base or other insulating material to prevent wall coupling effect.

g. Thermostats shall be mounted with the top at a maximum of 48" A.F.F. and shall be mounted to comply with A.D.A.

h. Thermostats shall provide temperature dead band of 5˚ F as required by IECC 2012.

i. Thermostat, or any other DDC sensor back box in rated walls shall be a minimum distance apart as allowed by code to maintain the rating. If closer, provide rated box or fireproofing in code approved manner.

C. DAMPERS

(1) Several louvers of practical widths shall be provided for larger dampers. Modulating dampers shall have opposed blades. Dampers shall have edge and end seals. Dampers shall be Ruskin CD-60 or better. Maximum leakage rate shall be 2 CFM per square foot at 1" W.G. pressure differential for dampers greater than 12" wide. Leak rate for dampers 12" and less shall be 3 CFM per square foot. NOTE: Do not mount outside air dampers so close to water coils, piping, etc., that freeze-up may occur due to a leaky damper.

D. RELAYS AND SWITCHES

(1) Relays and switches shall be of the positive and gradual acting type and shall be furnished and installed as required for the successful operation of the system. All switches shall have suitable indicating plates.

E. VALVES

(1) All valves shall be of the fully modulating and silent type unless otherwise specified. They shall provide accurate control of the heating or cooling medium under all load conditions. All valves

2-inches or smaller shall have brass or bronze bodies with screwed ends. Valves 2-1/2 inches and larger shall have iron bodies, brass or bronze trimming with flange ends. Valves shall be normally open or normally closed as required. Valves shall be installed with the stem in the upright position or as recommended by the valve manufacturer.

5. DEMONSTRATION

A. A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall demonstrate on -site with the Owner and Engineer that all points and sequences operate as designed.

The warranty does not start until all controls, graphics, points, etc. are functioning.

All controls functioning on _____ Date

Witnessed by _____

6. SEQUENCE OF CONTROL

A. Control Zones:

(1) All control zones shall be provided with occupied/unoccupied scheduling, holiday scheduling and timed override(s).

END OF SECTION 250200

SECTION 260501 - GENERAL PROVISIONS - ELECTRICAL

1. GENERAL

A. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. The Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating electrical systems indicated on the drawings and/or specified herein.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the electrical systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

E. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

F. This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

G. It is the intent of this Contract to deliver to the Owner a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or

new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.

H. The Contractor shall provide interim life safety and fire detection measures as required by the Authority Having Jurisdiction, Division 1 specifications, NFPA, and applicable Codes. This includes temporary relocations of heat/smoke detection, exit signage, and egress lighting in existing buildings as applicable.

I. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without request for extra compensation to the Owner, except where otherwise provided for in the contract document.

J. Definitions:

(1) Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.

(2) Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.

Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

(3) Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.

(4) Engineer - The Consulting Mechanical-Electrical Engineers, either consulting to the Owner, Architect, other Engineers, etc.

(5) Architect - The Architect of Record for the project, if any.

(6) Furnish - Deliver to the site in good condition.

(7) Provide - Furnish and install in complete working order.

(8) Install - Install equipment furnished by others in complete working order.

(9) Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

2. INTENT

A. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."

B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

3. ELECTRICAL DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.

B. The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

C. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. The Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.

F. The Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

G. Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

H. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

I. The drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

J. The Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.

K. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

4. EXAMINATION OF SITE AND CONDITIONS

A. The Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors or suppliers shall carefully examine all Drawings and Specifications and contract documents to determine the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.

B. The Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. The Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility

B. References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer is equivalent to that specified, provided the provisions of paragraph (A) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.

D. The Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

E. The Contractor shall review the contract documents and if a material substitution form is required for each proposed substitution, it shall be submitted per requirements.

6. SUPERVISION OF WORK

A. Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

7. CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.

B. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

C. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.

D. All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.

E. All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.

F. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.

G. The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.

H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith

will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

8. COST BREAKDOWNS/SCHEDULE OF VALUES

A. Within thirty days after acceptance of the Contract, the Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted. Refer to the end of this section for a sample of expected level and breakout being required.

9. CORRECTION PERIOD

A. All equipment, apparatus, materials, etc., shall be the best of its respective kind. The Contractor shall replace all materials at his own expense, which fail or are deemed defective as described in the General Conditions. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Architect or Engineer as being substantially complete.

B. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

10. INSPECTION, APPROVALS AND TESTS

A. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

B. The Contractor shall provide as part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the Commonwealth of Virginia. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.

C. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work.

Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

D. Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

E. Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

F. Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

G. The Contractor shall test all wiring and connections for cross connects, continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by continuity/load/voltage test and Megger Test the installation of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, replacing same with new and demonstrate by further test the elimination of such defect. The secondary service entrance conductors from the utility (source) transformer to the main service disconnecting means shall be megger tested. The results of this test shall be turned over to the engineer for review and approval. Any conductor failing the test shall be replaced and any costs associated shall be borne by the contractor.

11. COMPUTER-BASED SYSTEM SOFTWARE

A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

12. CHANGES IN ELECTRICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

13. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. SURVEYS, MEASUREMENTS AND GRADES

A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

15. TEMPORARY USE OF EQUIPMENT

A. The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.

B. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

16. TEMPORARY SERVICES

A. The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

17. RECORD DRAWINGS

A. The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically to the Engineer in AutoCad 2000

format (or more recent version) along with the hand marked field set. Electronic bid drawings will be furnished to the Contractor for his use at the completion of the work.

18. MATERIALS AND WORKMANSHIP

A. All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).

B. All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.

C. All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.

D. Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.

E. All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.

F. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

19. QUALIFICATIONS OF WORKMEN

A. All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

B. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

C. Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

20. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

21. COOPERATION AND COORDINATION BETWEEN TRADES

A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.

B. Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

22. PROTECTION OF EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

23. CONCRETE WORK

A. The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.

B. All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than l8" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.

Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.

C. In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads l8" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.

D. Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, trowelled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

24. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.

A. The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable.

25. MAINTENANCE OF EXISTING UTILITIES AND LINES

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.

B. Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.

C. If the above mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area. Electromagnetic utility locators and acoustic pipe locators shall be utilized to determine where metallic and non-metallic piping is buried prior to any excavation.

D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

E. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.

G. Protect all new or existing lines from damage by traffic, etc. during construction.

H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

26. SMOKE AND FIRE PROOFING

A. The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

27. QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

A. All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

28. FINAL CONNECTIONS TO EQUIPMENT

A. The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturers representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

29. WELDING

A. The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

30. ACCESSIBILITY

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.

B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull

boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.

C. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.

D. Access Doors; in Ceilings or Walls:

(1) In mechanical, electrical, or service spaces:

14 gauge aluminum brushed satin finish, 1" border.

(2) In finished areas:

14 gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.

(3) In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

31. ELECTRICAL CONNECTIONS

A. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Divisions 11, 14, 20, 21, 22, 23 and 25 of the Specifications, shop drawings and equipment schedules for additional information.

B. All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Division 26 and 27 regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.

C. Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

32. MOTORS

A. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

B. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 20, 22 and 23 of the Specifications for further requirements and scheduled sizes.

C. All three-phase motors shall be tested for proper rotation. Correct wiring if needed and retest. Document testing and corrective action in operations and maintenance manual.

33. CUTTING AND PATCHING

A. Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

B. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

34. ANCHORS

A. Each Contractor shall provide and locate all inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

35. WEATHERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The

Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

36. OPERATING INSTRUCTIONS

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

B. Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

C. Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

D. Formatting & content shall follow the guidelines outlined in the latest version of ASHRAE Applications Handbook, Guideline 4. As a minimum, the following shall be included:

- The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
- Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:

I. General Information
   a. Building function
   b. Building description
   c. Operating standards and logs

II. Technical Information
   a. System description

b. Operating routines and procedures
c. Seasonal start-up and shutdown
d. Special procedures
e. Basic troubleshooting

- The maintenance manual should contain the following information:
  I. Equipment data sheets
     a. Operating and nameplate data
     b. Warranty

  II. Maintenance program information
     a. Manufacturer's installation, operation, and maintenance instructions
     b. Spare parts information
     c. Preventive maintenance actions
     d. Schedule of actions
     e. Action description
     f. History
- Test reports document observed performance during start-up and commissioning.

37. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

38. CLEANING

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

39. PAINTING

A. Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

40. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

41. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold

CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

42. ABOVE-CEILING AND FINAL PUNCH LISTS

A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

(1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.

(2) For review of all other work as the project nears substantial completion.

B. When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $140.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

The following is CMTA's guide for required electrical information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

Electrical

Description of Work	Scheduled Value	Labor	Material
Shop Drawings			
Mobilization/Permits			
Temporary Utilities			
Demolition			
Greenhouse Connection			
Branch Panels			
Feeder Conduit			
Branch Conduit			
Feeder Wire			
Branch Wiring			
Fire Alarm Conduit & Wiring			
Fire Alarm Devices			
Light Fixture Interior			
Light Fixture Exterior			
Lighting Control System			

Wiring Devices			
Voice/Data System			
Paging/Intercom System Rough-in and cabling			
GPS Wireless Clock System Rough-in and cabling			
Access Control System Rough-in and cabling			
Digital Video Surveillance System Rough-in and cabling			
Electrical Inspection			
Owner Training			
Record Drawings			
O & M Manuals			
Punch List / Closeout			

END OF SECTION 260501

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

1. GENERAL

Each Electrical Contractor's attention is directed to Section 26 05 01 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

2. SCOPE OF THE ELECTRICAL WORK

The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, verify place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

A. All conduits, conductors, outlet boxes, fittings, etc.
B. All switchgear, panels, disconnect switches, fuses, interior non-utility transformers, contactors, starters, etc.
C. All wiring devices and device plates.
D. All light fixtures and lighting control system
E. All low voltage and AV systems.
F. Connection to existing building Paging/Intercom/Clock system. Contractor to provide all cabling and rough-in and owner to contact vendor on installation of end devics and programming.
G. Connection to existing Access Control System. Contractor to provide all cabling and rough-in and owner to contact vendor on installation of end devics and programming.
H. Connection to existing Digital Video Surveillance System. Contractor to provide all cabling and rough-in and owner to contact vendor on installation of end devics and programming.
I. Electrical connection to all electrically operated equipment furnished and/or installed by others, including powered casework, kitchen equipment, etc.
J. Expansion of existing Siemens fire alarm system.

END OF SECTION 260502

SECTION 260503 - SHOP DRAWINGS, LITERATURE, MANUALS, PARTS LISTS, AND SPECIAL TOOLS

1. SHOP DRAWINGS

A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

D. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

F. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

Power Equipment

- Panelboards.
- Circuit breakers per each type.
- Dry-type transformers.
- Disconnect switches.
- Control components (relays, timers, selector switches, pilots, etc.)
- Grounding system.

Raceways

- Wireways and each type of wireway fitting.

Devices

- Each type of wiring device and their coverplates.
- Any special items not listed above.

Lighting

- Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
- Lighting standards or poles.
- Photocells, time clocks or other lighting accessories.
- Lighting control system schematic, functional & programming data, along with building specific floor plan drawings indicating each device, master controller, input device locations and specific interconnect/wiring requirements for each device.

Systems

Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Include system specific wiring schematics showing each device and its specific interconnect/wiring requirements. For rack mounted equipment, provide a scalable elevation drawing with proposed component locations & specific interconnect wiring requirements for each component/panel. Also provide scale building specific layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.

- Expansion of existing fire alarm system

Miscellaneous

- Control panel assemblies.
- Non-standard junction/pullboxes.
- Hand holes, and all outdoor electrical equipment and fittings.

2. SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

3. FIRE ALARM SHOP DRAWINGS

A. The Contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to the Contractor's submittal to the governing authority for their review. No work shall be done until drawings are approved by the Authority Having Jurisdiction.

4. MAINTENANCE AND OPERATION MANUALS

A. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided. Formatting and content shall follow the guidelines outlined in the latest version of ASHRAE Application Handbook, Guideline 4. As a minimum, the following shall be included:

- The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
- Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:
  I. General Information
     a. Building function
     b. Building description
     c. Operating standards and logs

  II. Technical Information
     a. System description
     b. Operating routines and procedures

c. Seasonal start-up and shutdown
d. Special procedures
e. Basic troubleshooting

- The maintenance manual should contain the following information:
  I. Equipment data sheets
     a. Operating and nameplate data
     b. Warranty

  II. Maintenance program information
     a. Manufacturer's installation, operation, and maintenance instructions
     b. Spare parts information
     c. Preventive maintenance actions
     d. Schedule of actions
     e. Action description
     f. History

- Test reports document observed performance during start-up and commissioning.

END OF SECTION 260503

SECTION 260504 - SLEEVING, CUTTING, PATCHING, AND REPAIRING

1. GENERAL

A. The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He/She shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

B. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the building by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

C. The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

D. The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

E. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

F. Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

G. In all cases, sleeves shall be at least two inches larger than nominal pipe diameter.

H. Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed. Any roof penetration shall not void or lessen the warranty in any way.

I. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

J. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.

K. The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

L. All work improperly done or not done at all as required by the Contractor will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

2. SLEEVES, PLATES AND ESCUTCHEONS

A. The Contractor shall provide and locate all sleeves required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for conduits where sleeves were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the conduit and the sleeves shall be made completely and permanently water tight.
B. Conduits that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.
C. At all other locations either pipe sleeves or core drilled openings are acceptable.
D. Where thermal expansion does not occur, the wall may be sealed tight to the conduit.
E. Sleeves shall be constructed of rigid steel conduit. Sleeves in floors shall extend 6" above finished floor level.
F. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.
G. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.
H. Escutcheon plates shall be provided for all conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the sleeves.

END OF SECTION 260504

SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

A. The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing, Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.

B. Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.

C. The Contractor shall be responsible for coordination with all trades to insure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.

D. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.

E. In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

2. INTERFACING

Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is affected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):

A. Connection of all controls to equipment.

B. Electrical power connections to electrically operated (or controlled) equipment.

C. Electrical provisions for all equipment provided by other trades or suppliers within this contract.

3. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.

B. All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.

C. Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.

D. Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.

E. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.

F. The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION 260508

SECTION 260519 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES & CONNECTORS

1. GENERAL

A. This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.

B. All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.

C. No more than 40% conduit fill is permitted for any conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.

D. Lighting circuits: No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.

E. Receptacle circuits: If multiple circuits are pulled in a single homerun, a dedicated neutral shall be provided for each phase conductor. In these cases, a maximum of seven conductors are permitted in a single conduit. Conductors shall be derated per N.E.C.

F. Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

2. MATERIALS

A. CONDUCTORS

(1) All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.

(2) Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.

(3) Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.

(4) Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes.

(5) All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.

(6) The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to 260519-4, Color Coding.

(7) All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.

(8) Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.

(9) Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.

(10) All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.

(11) Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop. As calculated using 80% of the supply breaker rating as the load. Adjust conductors and conduit size accordingly for actual field installed conditions.

(12) No aluminum conductors shall be used.

B. SPLICING DEVICES & CONNECTORS

(1) Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.

(2) Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.

(3) Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.

(4) Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.

(5) Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.

(6) Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.

(7) The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.

3. INSTALLATION

A. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.

B. The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.

C. Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Also provide plenum-rated tie-wraps where plastic straps or other supports, etc., are installed in plenum areas.

D. Where indicated, communications conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.

E. Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.

F. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.

G. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 6 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

H. Where multiwire branch circuits are allowed, the phases and neutral shall be wire-tied together in the panelboard and in all pull boxes.

4. COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS

A. Conductors to be color coded as follows:

(1) 120/208 Volt Conductors
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - Solid White or White with tracer stripe to match phase conductor

(2) 277/480 Volt Conductors
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral – Solid Gray or White with tracer stripe to match phase conductor

Note: Further identify isolated power conductors with 2" wide purple tape at all terminations and junctions.

(3) Control Wiring - Red, or as indicated.

(4) Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.

(5) D.C. Wiring - Positive - Light Blue
Negative - Dark Blue

END OF SECTION 260519

SECTION 260526 - GROUNDING

1. GENERAL

A. All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.

B. The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.

C. Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.

D. The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.

2. MATERIALS

A. Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.

B. All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermically welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent. Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.

C. Ground electrode pipe systems shall be solid copper construction. Ground rods shall be 5/8" minimum diameter, eight feet long, copperweld steel. All ground electrode systems shall be installed in accord with manufacturer's recommendations, U.L. listings, National Electrical and National Electrical Safety Codes.

3. INSTALLATION

A. All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of

grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.

B. All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".

C. Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

D. Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.

E. All circuits shall have a separate grounding conductor, except as otherwise noted.

F. When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.

G. The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.

H. Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermically welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.

I. Grounding connections shall never be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.

J. Where dielectric fittings are utilized in piping systems, the piping system shall not be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall not be utilized as ground paths except where specifically required by codes in the case of water piping.

END OF SECTION 260526

SECTION 260531 - CABINETS, OUTLET BOXES AND PULL BOXES

1. GENERAL

   A. This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.

   B. Continuous runs of conduit shall have properly sized pull boxes at least each eighty-five feet of run, or as near as possible to that limit.

2. MATERIALS & INSTALLATION

   A. Cabinets, Outlet and Pull Boxes:

      (1) Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above.

      (2) All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.

      (3) Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers. Those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.

      (4) Special size concealed outlet boxes for clocks, speakers, alarms, panels, etc., shall be provided by the manufacturer of the equipment.

      (5) Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to centerline of box:

         Wall Switches, Control Stations ..... 3'-10"
         Convenience Outlets ..... 1'-6"
         Convenience Outlets - Above Counters ..... Bottom at 2" above top of backsplash
         T.V. Outlet receptacle - At Wall Brackets ..... refer to AV drawings and electrical legend
         Weatherproof Outlets ..... 2'-2"
         Disconnects, Branch Panelboards ..... 5'-0" max. to centerline
         Fire Alarm Manual Stations ..... 3'-10"

Fire Alarm Audio and/or Visual Units …….80" AFF to bottom of device or 6" below ceiling, whichever is lower.

(6) The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.

(7) Boxes installed in fire rated assemblies shall not compromise the rating of the assembly. The Contractor is responsible for identifying assembly ratings and construction requirements prior to rough-in.

a. Listed single and double gang metallic outlet and switch boxes with metallic or nonmetallic cover plates may be used in bearing and nonbearing wood stud and steel stud walls with rating not exceeding 2 h. The boxes shall be fastened to the studs with the openings in the wallboard facing cut so that the clearance between the boxes and the wallboard do not exceed 1/8 in. The boxes shall be installed so that the surface area of individual boxes do not exceed 16 sq in, and the aggregate surface area of the boxes do not exceed 100 sq in per 100 sq ft of wall surface unless approved alternate protection materials are used.

b. Boxes located on opposite sides of walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between the boxes may be reduced when listed Wall Opening Protective Materials are installed according to the requirements of their Classification.

c. Boxes installed on opposite sides of walls or partitions of staggered stud construction shall have listed Wall Opening Protective Materials installed with the boxes in accordance with Classification requirements for the protective materials.

d. All installation shall be done in accordance with AHJ requirements.

(8) All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.

B. Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight, vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved equivalent.

(1) NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.

(2) Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 2" X 4" X 2" with plaster cover for the number of devices as required. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls, unless noted otherwise.

(3) Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.

(4) Boxes for more than two devices shall be for the number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

(5) Outlets provided shall have only the holes necessary to accommodate the conduit at the point of installation and shall be rigidly secure in position. Boxes with knockouts removed and openings not used shall be replaced or be provided with a listed knockout closure.

(6) Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

END OF SECTION 260531

SECTION 260533 - RACEWAYS & FITTINGS

1. GENERAL

A. This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.

B. This section specifies basic materials and methods and is a part of each Division 26, 27 and 28 that implies or refers to electrical raceways specified therein.

C. The types of raceways specified in this section include the following:

(1) Steel electrical metallic tubing. (E.M.T.)
(2) Rigid galvanized steel conduit. (G.R.S.)
(3) Intermediate metal conduit (I.M.C.).
(4) Rigid aluminum conduit.
(5) Flexible metal conduit (aluminum or steel)
(6) Metal-Clad Cable
(7) Liquid - tight flexible metal conduit.
(8) Rigid nonmetallic conduit.

D. All raceways, as listed in 1C. above and otherwise specified herein shall be provided in compliance with latest editions of all applicable U.L., NEMA, N.E.C. and A.N.S.I. standards. All conduit, raceways and fittings shall be Underwriters Laboratories listed and labeled, or bear the listing of an agency acceptable to the local authority having jurisdiction.

E. Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.

F. P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.

G. The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.

H. Minimum size of conduit shall be 3/4" trade size. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.

I. The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

2. MATERIALS

A. STEEL ELECTRICAL METALLIC TUBING

(1) Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer.

B. RIGID GALVANIZED STEEL CONDUIT

(1) Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C. conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.

C. INTERMEDIATE METAL CONDUIT

(1) Unless otherwise indicated on the drawings, intermediate metal conduit (I.M.C.) may be used in any location in place of rigid galvanized steel conduit, as permitted by codes, and as approved by the Engineer.

D. RIGID ALUMINUM CONDUIT

(1) Rigid aluminum conduit, shall be permitted for installation indoors in dry locations only. Under no conditions shall it be cast into concrete slabs or pass thru construction where prolonged contact will degrade the aluminum. All ells used in rigid aluminum conduit systems shall be rigid galvanized steel. Rigid aluminum conduit shall always be used for power wiring greater than 5 KVA and higher than 60 Hz frequency.

E. Metal-Clad Cable or MC CABLE

(1) Metal Clad (MC) cable shall be used where permitted by NEC. It may be constructed of aluminum or steel. Conductors to be copper – solid for #10 and smaller and stranded for #8 (MC cable not allowed for cables larger than #8). MC cable shall only be used in interior concealed areas above a lay-in or gypsum ceiling. It may be used for device installation in metal stud construction. It is not to be installed in masonry walls or in areas with exposed ceilings. Where panelboards are located in mechanical / electrical closets, MC can terminate into panelboard enclosure. MC cable is allowed for all general purpose receptacle and lighting (including lighting whips) for 277/480V or 120/208V 20A and less circuits. This includes. MC

cable must be fastened/secured to decking/floor above with clamps or fasteners at not more than six foot intervals. It shall be independently fastened from all other MEP systems. MC cable CANNOT be used for Plumbing, Kitchen, HVAC, or other specialty equipment.

F. FLEXIBLE METAL CONDUIT

(1) Flexible conduit shall be used where permitted by NEC. It may be constructed of aluminum or steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Maximum distance of flexible conduit shall not exceed 72”.

G. LIQUIDTIGHT FLEXIBLE METAL CONDUIT

(1) Weatherproof flexible metal conduit shall be wound from a single strip of steel, neoprene covered, equivalent to "Liquatite" or "Sealtite" Type "UA". It shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" as required where subject to vibration. Flexible connections to motors in dusty areas shall be dust-tight, in areas exposed to the weather - weatherproof.

H. RIGID NON-METALLIC CONDUIT

(1) Rigid non metallic conduit shall be constructed of P.V.C, nominally schedule 40 weight, except where encased in concrete, where it may be "EB" type. If installation will enclose utility company provided conductors, verify exact type required and install in accord with their standards, if more stringent than this specification.

(2) Rigid non-metallic conduit may be used in exterior wet or damp locations where installed underslab or underground. It shall not be run in interior locations, except with special permission from the Engineer for use in corrosive environments, and then only if protected from physical damage. No rigid nonmetallic conduit may be installed in environmental air plenums or cast into above-grade concrete slabs. No rigid nonmetallic conduit may be installed in locations where the ambient temperature might exceed the rating of the raceway.

(3) Where rigid non metallic conduit is placed underground, as for feeder circuits, secondaries or branch circuit runs and where ell is made upward thru a slab on grade, transition the turning ell and the riser to rigid steel conduit to a height of 6" above the concrete slab. Transition may then be made to E.M.T or other approved conduit for remainder of run.

(4) Flexible nonmetallic conduit shall not be used, except by special permission, obtained in writing from the Engineer.

(5) Provide equipment grounding conductors of copper, sized as required by codes, in all circuits installed in rigid nonmetallic raceways.

I. RACEWAY FITTINGS

(1) Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.

(2) Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

(3) Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) sealoff fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

(4) Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

(5) Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

(6) Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with 3/4" rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

(7) Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

(8) Fittings for E.M.T. conduit shall be of the compression type. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction.

(9) Indentation or die-cast fittings shall <u>not</u> be permitted in any raceway system.

(10) All conduit fittings shall be securely tightened. All threaded fittings shall be engaged seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

J. SUPPORTS AND HANGERS

(1) Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending on the support systems of other trades' work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.

(2) REFER TO GENERAL NOTES OF STEEL JOIST SPECIFICATION SECTION FOR GENERAL HANGER REQUIREMENTS AT METAL DECK AND JOISTS.

(3) No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.

(4) Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.

(5) The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.

(6) Individual conduits run on building walls or equipment shall be secured by one hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.

(7) Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.

(8) Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth, 12 gauge. Utilize conduit clamps appropriate to the channel.

(9) Channel strut systems for supporting electrical equipment or raceways in outdoor wet or corrosive locations shall be constructed of 12 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent. In indoor dry locations, factory finish paint will be acceptable.

(10) The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.

(11) Welding directly on conduit or fittings is not permitted.

(12) Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.

(13) Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.

(14) Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

(15) Provide supports/hangers at opposite corners of 2x4/2x2/1x4 recessed lay-in style fixtures and connect to structure.

3. INSTALLATION

A. This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall as a minimum conform to the National Electrical Code, unless larger size is indicated on the Contract Drawings.

B. No conduit larger shall be installed in poured concrete slabs except with permission of the structural engineer. All other shall be held below slab. Conduit shall be held at least 6" from flues or hot water pipes.

C. All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.

D. Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90º bends.

E. Junction boxes shall be installed so that conduit runs will not exceed 85', as shown on the Contract Drawings.

F. Underground electric, cable TV, telephone service or other rigid steel conduit and underfloor rigid steel conduit below the concrete floor slab shall be painted with two coats of bitumastic paint, such as "Asphaltum".

G. All underground or underfloor conduits shall be swabbed free of all moisture and debris before conductors are pulled.

H. At least two 1 inch and four 3/4 inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.

I. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.

J. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.

K. Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure or route through joists webbing wherever possible, to maximize available space and not restrict other trades.

L. Complete installation of electrical raceways before starting installation of cables or wires within raceways.

M. All underground conduits shall be buried to minimum depth of 24" from the top of the concrete encasement or raceway to finished grade, unless otherwise noted on plans. Observe minimum burial requirements of local utility company where their standards or regulations apply. Conduits containing primary power conductors, (higher than 600 volts to ground) shall be 42" to top below finished grade, unless otherwise noted on plans.

N. All raceways shall be installed to maintain a minimum of 4” clearance below roof decking.

4. SPECIALTIES

A. All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is <u>not</u> permitted.

B. All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.

C. All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.

D. All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.

E. Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.

END OF SECTION 260533

SECTION 260544 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

1. GENERAL

   A. Each Contractor's attention is directed to Section 26 05 01, General Provisions, Electrical and all other contract documents as they may apply to his work.

   B. Each Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.

   C. Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Phone cable may, at the Contractor's option, and if acceptable to both utility companies, be placed in a common trench with power lines as long as 8" of earth separation is maintained. T.V. cable shall, in all cases, be placed in a separate trench with two feet separation from electrical power lines.

   D. Depths of bury shall be as indicated on the drawings.

2. SUBSURFACE DATA

   A. Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made. No claim for extra compensation, or for extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown.

   B. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

3. BENCH MARKS AND MONUMENTS

   A. Maintain carefully all bench marks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

4. EXCAVATION

   A. Each Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.

   B. Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools.

C. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.

D. Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.

E. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor.

5. BACKFILL

A. Backfill shall be accomplished with clean debris free earth and the new earth tamped at 12" intervals so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.

B. Backfill trenches only after conduit and cable have been inspected, tested, and locations of pipe lines have been recorded on "as-built" drawings.

C. The backfill below paved areas shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill.

D. The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATIONS

1. GENERAL

A. Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" white lamacoid plate (or equivalent) with black letters 1/4" high. PROVIDE PANEL NAME AND CIRCUIT NUMBER ON ALL DISCONNECTS.

B. The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc., controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel. The Contractor shall be required to demonstrate the accuracy of the panel directory for a random sampling of circuits in each panelboard as directed in the field by the Engineer with corrections made immediately so it is imperative that care be taken during installation to insure 100% accurate directories.

C. All circuit breakers and disconnects serving fire alarm equipment shall be painted red and clearly labeled as Fire Alarm Circuits.

D. Branch circuit panelboards and switch gear shall be provided with a white lamacoid plastic plate with 1/2" black letters for panel designation and 1/4" black letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Panelboards shall also indicate color coding of the branch circuit phase conductors supplied. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment <u>prior</u> to submission of shop drawings.

EXAMPLE:

PANEL “XYZ” FED FROM “MDP – 2” 120/ 208/ 3PH/ 4W – 225A BLACK-RED-BLUE CONDUCTORS

E. Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.

END OF SECTION 260553

SECTION 230800 – COMMISSIONING OF ELECTRICAL SYSTEMS

1. GENERAL

A. RELATED WORK

1. Division 22 – Plumbing

2. Division 23 - Mechanical

B. REFERENCES

1. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions and Division-1 Specification sections, apply to work of this section.

2. ASHRAE Guideline 1-1996

3. ASHRAE Guideline 0-2005

4. ACG Commissioning Guideline – 2005

B. DESCRIPTION OF WORK

1. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the electrical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

2. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

3. Assemble and submit a Project Manual detailing installed systems, maintenance schedules, contractor contact information, a system verbal description, system diagrams, the TAB report, lighting startup reports, electrical commissioning report for including in the Project Manual.

2. PRODUCTS

A. Not used.

3. EXECUTION

A. ROLES OF THE COMMISSIONING AGENCY

1. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of Electrical systems within the facility.

2. The CA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

3. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

4. The CA shall observe and coordinate testing as required to assure system performance meets the design intent.

5. The CA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.

6. The CA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.

7. The CA is to remain an independent party with specific knowledge of the project. The CA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CA shall monitor resolution for conformance with design intent and prevailing industry standards.

8. The CA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for Electrical systems and subsystems.

9. The CA will review operating and maintenance materials for Electrical systems.

10. The CA will review phasing plans as provided by the CM relating to temporary use of Electrical equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

B. SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

1. Lighting Control Systems

C. ELECTRICAL COMMISSIONING PLAN

1. Commissioning Team

a. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:

Program Manager (PrM)
Facilities Management Division (FMD)
Commissioning Agent (CA)
Design Team (DT)
Construction Manager (CM)
Mechanical Contractor (MC)
Controls Contractor (CC)
Test and Balance Contractor (TABC)
Electrical Contractor (EC)

2. Basis of Design Document

a. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.
b. The CA will review the BOD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

3. Commissioning Meetings

a. Commissioning meetings will be held in conjunction with progress meetings as necessary. The CA will be on site for the CX meetings. Commissioning meetings will be used to address

any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

4. Resolution Tracking Forms (RTF)

   a. The use of Resolution Tracking Forms is a method employed by the CA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
   b. The CA will regularly submit RTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

5. System Verification Checklists (SVC) / Manufacturers' Checklists

   a. The EC shall provide SVC's based on the manufacturers start-up procedures. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS*. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
   b. The CA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CA.
   c. The equipment manufacturers' checklists must also be reviewed by the CA prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CA before start-up can commence.

6. Start-Up

   a. Start-up of major Electrical systems will be witnessed the CA. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting Electrical equipment.
   b. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BoD.

7. Functional Performance Tests (FPT)

a. The CA will write FPT's based on the BoD. These tests will be created for systems and subsystems. See *SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS* above.
b. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CA and the owner's maintenance staff. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation.
c. The Functional Performance Tests shall include Electrical, Lighting, PV and related equipment.

    1. The Electrical trade representative will demonstrate to the CxA: main power disconnect switch and feeder disconnect switches over current ground fault sensor trip settings by the primary injection method and in accordance with NETA-ATS Section 7.6, switchboard assemblies megger tested in accordance with NETA-ATS Section 7, switchboard metering instrumentation tests in accordance with NETA-ATS Sections 7.10 and 7.11, and switchboard single phase monitor tests for operation upon loss of a phase.

    2. The Electrical trade representative, with the CxA present, will field test for power operation for the emergency generator and transfer switches.

    3. Lighting controls will be tested under relevant operating conditions.

    4. A remote connection to energy metering system, energy dashboard, PV system, or any other system should be provided to the CA prior to system start-up for use as a tool to determine completion and accuracy of systems. CA in conjunction with the CT will ensure that all systems function properly through FPT's and through trend verification of systems.

d. Deferred Testing

    1. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.
    2. Off-season mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications.

e. Rescheduled Functional Performance Test

    1. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, contractor shall reimburse the owner for all additional cost the owner incurs as a result

of the contractor's failure to be complete and/or to provide operating compliant systems for commissioning. Additional costs include but are not limited to additional fees charged by the architect, engineer, construction manager and commissioning agent.

2. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed for the commissioning personnel's return trip.

8. Building Turn-Over / Owner Orientation / User Training

   a. The CA will assist contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
   b. The CA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.
   c. Owner training will be coordinated with the assistance of the CA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CA will visit the site during the Turn-Over and Training period to assure that any on-going ELECTRICAL related problems are being addressed and corrected in a timely and efficient manner.
   d. The CA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

D. RESPONSIBILITIES OF TEAM MEMBERS

1. Construction Manager (CM)

   A. Include commissioning requirements in the mechanical, electrical, and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the Electrical commissioning process.
   B. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
   C. Assure that the CA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
   D. Coordinate inclusion of commissioning activities in the construction schedule.
   E. Facilitate resolution of deficiencies identified by observation or performance testing.

2. Electrical Contractor (EC)

A. Include cost for commissioning requirements in the contract price.
B. Review design for provision of power to the Electrical equipment.
C. Attend commissioning meetings scheduled by the CA.
D. Verify proper installation and performance of all Electrical services provided.
E. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of equipment.
F. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
G. Provide an Electrical system technician to assist during verification and performance testing.
H. Participate in the Functional Performance Tests as required to achieve design intent.
I. Participate in the off-season mode testing as required to achieve design intent.
J. Participate in O&M Training as required by project specifications.

END OF SECTION 260800

SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

1. GENERAL

A. All electrical distribution equipment shall be dead front UL listed for the purpose and application. All equipment shall meet or exceed all applicable requirements of the National Electrical Code (N.E.C.). Any device or component, i.e., switchboard, panel, breaker, switch, etc., used as service entrance equipment, shall be listed for use at 100% of the rated capacity.

2. DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER)

A. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.

B. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.

C. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50ºC. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.

D. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.

E. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on schedules on the plans or as determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the

specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

F. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

G. Provide energy reducing maintenance switch with local status indicator for any breaker or equipment rated or adjustable to 1,200 Amps or greater.

H. Distribution panelboards shall be Square "D" to match existing manufacturer.

I. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

3. BRANCH PANELBOARDS

A. This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).

B. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.

C. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, plug-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

D. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.

E. Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings or Fault Current Study. For 277/480 volt systems, provide circuit breakers with 14,000 A.I.C. ratings unless otherwise indicated or Fault Current Study.

F. All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards.

G. All circuit breakers used to switch lights shall be SWD (switching duty) rated and U.L. listed for the purpose.

H. Where branch circuit breakers feed hermetically, sealed compressor for cooling or refrigeration equipment, provide U.L. listed H.A.C.R.-style circuit breakers.

I. Where branch circuit breakers are indicated or required to be ground-fault circuit-interrupting type (G.F.C.I.), they shall have test and reset buttons and be U.L. listed, latest edition. Do not share neutrals with other circuits.

J. Where branch circuit breakers are feeding H.I.D. (high-intensity-discharge) loads, they shall be rated and listed for such loads. Provide proper circuit breaker whether indicated on panel schedules or not.

K. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

L. Panels shall be Square "D" to match existing manufacturer.

M. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

4. INSTALLATION INSTRUCTIONS

A. Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.

B. All dust and debris shall be removed from the panels before they are energized and placed in service.

C. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

D. All service equipment shall be marked with the maximum available fault current and the date of the calculation. This information shall be obtained in writing from the serving utility. Provide label adjacent to the service disconnecting means. Document action of the fault current shall be included in the operation and maintenance manual. This labeling shall be provided for all new service installations, service upgrades, and any project that adds or replaces distribution panels or branch panel boards.

E. Where applicable - Provide a warning sign on the service entrance equipment indicating type and location of all on-site emergency power sources in accordance with the NEC.

F. Where applicable – Provide warning sign(s) for alternative power devices (photovoltaic, wind, fuel cell, etc.) on all equipment in accordance with the NEC.

G. All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC. Refer to Section 264313 Surge Suppression Systems.

5. SAFETY SWITCHES

A. Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.

B. All safety switches shall be NEMA Type 1, NEMA 3R, NEMA 4 stainless steel, NEMA 12, or as required by the operating environment, Heavy Duty Type HD, UL listed.

C. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.

D. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

E. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

F. Arc Flash Hazard warning labels shall be affixed to all switches in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

G. Switches shall be as manufactured by Square D to match existing manufacturer.

6. FUSES

A. Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.

(1) 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:

(2) Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to insure retention of selective coordination, as designed.

C. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

D. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of l0 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

E. Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately l25% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

F. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

7. DISTRIBUTION TRANSFORMERS

A. The Contractor shall provide dry-type transformers as manufactured by Square "D" to match existing building equipment. KVA ratings shall be as indicated on the electrical plans and shall have copper windings.

B. Three phase transformers are to have 480 volt Delta primary and 120/208V/3Ø/4W secondary. 30 KVA transformers and larger are to be supplied with 2-22% full capacity taps above and (4) 2-1/2% full capacity taps below primary voltage. Exceptions to the above will be shown on the electrical plans.

C. Transformers 30 KVA and above shall be Class H, 115°C. and shall have the ability to carry a continuous 15% overload without exceeding a 115°C rise above 40° ambient.

D. Transformer coils shall be vacuum impregnated with non-hygroscopic, thermosetting varnish. Each layer shall have end fillers or tie downs to provide maximum mechanical strength. Insulation systems and their construction techniques shall be listed by Underwriters Laboratories.

E. Transformer coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire. Transformers having coils with magnet wire visible will not be acceptable.

F. All cores to be manufactured from a high grade, non-aging, silicon steel with high magnetic permeabilities, low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation to allow for a minimum of 10% over voltage excitation. The cores shall be clamped with structural angles (formed angles not acceptable) and bolted to the enclosure to prevent damage during shipment or rough handling.

G. The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie down facilities will not be acceptable.

H. Transformers 15 KVA thru 45 KVA shall be provided with interchangeable mounting for floor or wall.

I. The maximum top of case temperature shall not exceed 35°C above ambient.

J. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with baked enamel.

K. The core and coils shall be visibly grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size.

L. Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests on each unit furnished. The sound levels are not to exceed the following values: 10 to 45 KVA, 42 D.B. to 150 KVA; 45 D.B., 225 to 300 KVA; 50 D.B. and 500 KVA, 54 D.B.

M. If a particular “K” rating is specified for a dry-type transformer, that rating shall be provided.

END OF SECTION 262400

SECTION 262726 - WIRING DEVICES AND PLATES

1. GENERAL

A. This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.

B. Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

2. MATERIALS

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE - DUPLEX COMMERCIAL GRADE	125V, 20A	NEMA 5-20R	!	HUBBELL CR5362* GE 5362* LEVITON 5362*
	125V, 15A	NEMA 5-15R	!	HUBBELL CR5262** GE 5262** LEVITON 5262**
	* USE WHEN ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHEN ON DEDICATED 15A CKT., OR WHEN MORE THAN ONE RECEPTACLE ON A CIRCUIT			
RECEPTACLE - DUPLEX PREMIUM GRADE	125V, 20A	NEMA 5-20R	!	HUBBELL 5352* LEVITON 5362* GE 5362,*
	125V, 15A	NEMA 5-15R	!	HUBBELL 5252** LEVITON 5262** GE 5262**
	* USE WHERE ON DEDICATED 20A CKT., OR CALLED OUT ** USE WHERE ON DEDICATED 15A CKT., OR WHERE MORE THAN ONE RECEPTACLE ON A CIRCUIT			
RECEPTACLE - DUPLEX G.F.I. (SHALL MEET U.L. 943 STANDARD)	125V, 20A	NEMA 5-20R	!	HUBBELL GFR5352A

RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R	!	HUBBELL 5361
RECEPTACLE, SINGLE	250V, 20A	NEMA 10-20R	BLACK	HUBBELL 6810 GE 4124 LEVITON 5032
RECEPTACLE, SINGLE	250V, 30A	NEMA 6-30R	BLACK	HUBBELL 9330 GE 4139 LEVITON 5372
RECEPTACLE, SINGLE	250V, 50A	NEMA 6-50R	BLACK	HUBBELL 9367 GE 4141 LEVITON 5374

NOTE:

SWITCH, KEYED TO EACH BE FURNISHED WITH ONE HUBBELL #1209 KEY. TURN OVER TO OWNER AT CLOSE OF PROJECT AND OBTAIN RECEIPT FOR VERIFICATION THAT KEYS HAVE BEEN DELIVERED.

NOTES:

1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT.
2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE
3. FOR DRYERS AND RANGES, PROVIDE 3-POLE GROUNDING TYPE AS REQUIRED BY DEVICE. LOCATE DEVICE SO THAT DRYER OR RANGE CAN BE PUSHED TIGHTLY AGAINST WALL.
4. RECEPTACLES SHALL BE TAMPER RESISTANT AND WEATHER RESISTANT AND MARKED ACCORDINGLY AS REQUIRED BY N.E.C.
5. ALL RECEPTACLES INSTALLED IN DAMP OR WET LOCATIONS SHALL BE UL LISTED WEATHER RESISTANT TYPE.

! SEE ARTICLE 3, COLOR.

A. Small Motor Control Switches:

(1) For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch with thermal overloads. Overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures.

3. COLOR

A. Color of devices shall be as selected by the architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.

B. Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.

C. Where surface finishes next to the devices vary in color or shade throughout the project, the Contractor may be required to provide lighter or darker plates and devices to more closely match wall finishes. These variations are considered to be included in the original contract for construction.

4. PLATES AND COVERS

A. All faceplates to be bright 302 stainless steel type.

B. All kitchen, gymnasium or food service area plates shall be bright finish 302 stainless steel.

C. Cover plates shall be of one manufacturer insofar as possible.

D. Weatherproof plates for G.F.C.I. receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, cover closed. Vertical mounting - Hubbell WP26M, horizontal mounting - Hubbell WP26MH (die-cast zinc) or equivalent Leviton or G.E.

E. Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E. or Leviton.

F. Cover plates for computer, telephone or other system outlets shall be as required to meet supplier or the owner's requirements, as applicable. Color to match other plates on project. Furnish telephone plates with wall-mounting studs if mounted at 48" or higher. See devices schedule below.

5. STANDARD SINGLE-SERVICE FLOOR BOXES

A. In general, floor boxes to be used flush in concrete floors shall be of single-gang stamped steel construction, round, deep style, fully adjustable Hubbell B-2537 Series, Type 1 or equivalent.

B. Where multiple gangs are indicated on the plans (or elsewhere), multi-gang (up to 3 yokes maximum) stamped steel, rectangular, deep style units shall be used. They shall be fully adjustable,

Hubbell B-2432 Series, Type 1, or equivalent. Multiple-gang boxes shall be provided with removable partitions between each section in accord with N.E.C., where power and non-power circuits enter the same box.

C. In general, all cover plates for floor boxes shall be flush, solid brass. Provide typical plates as listed:

Duplex Outlet	- Round, Duplex Flap - Hubbell S-3925 - Rectangular, Duplex Flap - Hubbell S-3825
Telephone or Data	- Round, Combination 1" or 2 1/8" - Hubbell S-2725 -Rectangular, Combination 1" or 2 1/8" - Hubbell S-2625

D. Furnish floor boxes with threaded hubs as required to suit conduit routings, 3/4" minimum.

E. Furnish carpet flanges for all boxes installed in carpeted areas. Flanges to be clear polycarbonate plastic, round - Hubbell S-3079 or rectangular, for gangs indicated - Hubbell S-308 Series or equivalent.

F. Floor outlet boxes shall be installed dead level flush with wood, VCT, concrete or other hard surface type floor. Furnish special stop trims for terrazzo where required.

G. Outlets within floor boxes shall be as specified elsewhere in these specifications.

6. INSTALLATION

A. All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.

B. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.

C. Provide G.F.C.I. duplex feed-thru style receptacles in accordance with new U.L. Standard 943 where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "G.F.C.I. protected" label on each downstream outlet.

D. GFCI devices shall be installed in a “readily accessible” location per NEC requirements. GFCI protected outlets required by plans or code shall be fed by a GFCI breaker or upstream GFCI device if they are not readily accessible.

E. Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall

be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.

F. All receptacles shall be installed with ground prong at top position.

G. All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.

END OF SECTION 262726

SECTION 265113 - LIGHTING FIXTURES AND LIGHTING EQUIPMENT

1. GENERAL

A. Furnish and install all lighting fixtures, as herein specified, complete with accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections, apply to this Section.

C. All items furnished shall comply with the latest standards applicable such as U.L., NEMA, etc., and shall bear labels accordingly. All fixtures shall be the color specified or as selected by the Architect. Wherever fixtures have evident damage, they shall be restored to new condition or shall be replaced. Likewise, fixtures showing dirt, dust or fingerprints shall be restored to new condition or shall be replaced.

D. Shop drawings shall be submitted electronically – refer to Division 01. As part of shop drawings provide drawing illustrating interior lighting controls and shading. As part of LEED submittal for SS Credit 8, provide manufacturer's data for exterior lighting, including data on initial fixture lumens above 90 degrees from nadir for all exterior lighting fixtures, and for parking lot lighting, verification that the fixtures are classified by the IESNA as 'full cutoff' (FCO), OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program. Additionally, provide a description of the light trespass analysis and photometric site plan that includes a footcandle summary table.

E. Locate pendant, surface mounted or chain-hung industrial fixtures in mechanical rooms and similar spaces to avoid ductwork and piping. Locate around and between equipment to maximize the available light. Request a layout from the Engineer if uncertain about an installation.

F. Refer to drawings for acceptable manufacturers. Proposed substitutions must be submitted per Division 00 and Division 01.

G. All reflecting surfaces, glass or plastic lenses, downlighting Alzak cones and specular reflectors shall be handled with care during installation to avoid fingerprints or dirt deposits. It is preferred that louvers be shipped and installed with clear plastic bags to protect louvers. At close of project, and after construction air filters are changed, remove bags. Any louver or cone showing dirt or fingerprints shall be cleaned with solvent recommended by the manufacturer to a like-new condition, or replaced as necessary in order to turn over to the Owner new fixtures at beneficial occupancy.

H. Refer to architectural details as applicable for recessed soffit fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.

I. Warranty shall start at Final Project Completion.

2. VOLTAGE

A. All lighting fixtures will be rated 120 or 277 volts, single phase as indicated or required.

3. LED FIXTURES

LED SOURCES

A. LED's shall be manufactured by a manufacturer who has produced commercial LEDs for a minimum of five (5) years.
B. Lumen Output – minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
C. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours at the rated ambient operating temperature.
D. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
E. LED Boards shall be suitable for field maintenance and have with plug-in connectors. LED boards shall be upgradable
F. Light Color/Quality:
    a) Correlated Color temperature (CCT) range as per specification, between 3000K, 3500K and 4000K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
    b) Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.
    c) The color rendition index (CRI) shall be 80 or greater
    d) LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

LED DRIVERS

A. Driver: Acceptable manufacturer: eldoLED, Sylvania, or Philips that meet or exceed the criteria herein.
B. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
C. Driver should be UL Recognized under the component program and shall be modular for simple field replacement.
D. Electrical characteristics: 120 – 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.

E. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100 percent to 0.1 percent of rated lumen output with a smooth shut off function.
F. Dimming shall be controlled by a 0-10V signal, or if require "DMX".
G. Driver shall include ability to provide no light output when the control signal drops below 0.5 V, and shall consume 0.5 watts or less in this standby.
H. Driver shall be capable of configuring a linear or logarithmic dimming curve.
I. Drivers shall track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range regardless of the controller type
J. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have: Less than 1 percent flicker index at frequencies below 120 Hz and less than 12 percent flicker index at 120 Hz, and shall not increase at greater than 0.1 percent per Hz to a maximum of 80 percent flicker index at 800Hz
K. Driver disconnect shall be provided where required to comply with codes.

LED ELECTRICAL

A. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage and meet ANSI C82.11 maximum allowable THD requirements.
B. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A. To reduce false circuit breaker tripping due to turn on inrush, the following statement ensures that electronic dimming driver will meet NEMA inrush recommendations.
C. Rush Current: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps2 – seconds.
D. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions
E. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance.
F. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.

4. LIGHTING FIXTURE SCHEDULE

A. Refer to the contract drawings for Lighting Fixture Schedule

5. PHOTOCELLS

A. Provide photocell as part of network lighting control system.

B. Mount photocells in locations concealed from sight lines standing on ground unless otherwise noted, in which case the final position shall be as directed by the Architect. Group together (if indicated at one location) and mount on back of parapet wall or otherwise properly support with mounting bracket. Coordinate with roofing installer to ensure that roof penetrations are properly made without violating or reducing the roof warranty in any way. Photocells may be mounted in other locations if it is not practical to install them on roofs or parapets, in which case the Contractor shall request direction for their mounting locations from the Engineer or Architect. Photocells shall always be mounted in a weatherproof, inconspicuous manner.

C. Photocell shall be connected to network lighting control system for normal control of all building mounted and site lighting – refer to plans for locations.

6. TIMECLOCKS

A. Provide timeclock function as part of network lighting control system.

END OF SECTION 265113

SECTION 265116 - NETWORK LIGHTING SYSTEMS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (occupancy), and manual lighting control.

B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)

C. The system architecture shall provide stand-alone groups (rooms) of devices to function.

D. The system shall not require any centrally hardwired switching equipment.

E. The system shall be wired architecture, but can be capable to support wireless.

1.3 SUBMITTALS

A. Product Data: For each type of product.

A. Specification Conformance Document: Indicate whether the submitted equipment:
   A. Meets specification exactly as stated.
   B. Meets specification via an alternate means and indicate the specific methodology used.

B. Shop Drawings; include:
   A. Schematic (one-line diagram) of system.
   B. Mounting dimension requirements for each product and mounting condition.

C. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements for all switches, relays, sensors, equipment part of the lighting system.

D. Sequence of Operation to describe how each area operates and how any building wide functionality is described.

E. Provide coordination drawings showing interconnecting control wiring and interface devices.

F. Quality Control Submittals:
   A. Test Reports: Indicating compliance with specified fabric properties.
   B. Certification: Morton International Laboratory Report for PVC coated fabrics and

bacterial and mildew resistance.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 01 40 00 "Quality Requirements," which also defines "NRTL" (nationally recognized testing laboratory).

B. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

C. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

D. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

E. All applicable products must be UL/CUL Listed or other acceptable national testing organization.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

1.7 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.8 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty. Warranty shall start at Final Project Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight Stand Alone Control System from Sensor Switch,

equals by Watt Stopper, Cooper Controls, Lutron, or Hubbell.

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon two main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches.

D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and posses RJ-45 style connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation.

F. Devices within a lighting control zone shall be connected with CAT-5E low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes. Standalone “bus power supplies” shall not be required in all cases.

I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

J. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

K. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information.

L. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.

M. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Stand Alone Occupancy Sensors

1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.

4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable. Provide this type of sensor in all group restrooms.

5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

6. Sensors shall be include two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

7. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.

8. Sensors shall be available in multiple lens options which are customized for specific applications.

9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

10. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

11. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.

14. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.

15. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

16. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.

17. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray). Wall plates shall be brushed stainless steel

18. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls

19. Fixture mount sensors shall be capable of powering themselves via a line power feed.

20. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

21. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).

22. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output

B. Stand Alone Daylight (Photocell and or Dimming) Sensors

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be

manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).

5. Combination units that have all features of on/off photocell and dimming sensors shall also be available.

6. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.

7. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.

C. Stand Alone Metering Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.

2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system and come capable of metering connected load.

3. All devices shall have two RJ-45 ports.

4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.

5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.

8. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming of LED drivers.

9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of LED drivers.

10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.

11. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.

12. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.

D. Stand Alone Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.

2. Devices shall be available with zero or one integrated Class 1 switching relay.

3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

4. All sensors shall have two RJ-45 ports.

5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.

6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).

7. Devices with dimming control outputs can control 0-10 VDC

8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.

9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.

10. Devices with mechanical push-buttons shall be made available with custom button labeling

11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

E. Stand Alone Graphic Wall Station

1. Device shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.

2. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.

3. Device shall enable user supplied .jpg screen saver image to be uploaded.

4. Device shall surface mount to single-gang switch box

5. Device shall have a micro-USB style connector for local computer connectivity.

6. Device shall have two RJ-45 ports for communication

PART 3 – EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

D. Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

E. Install plenum cable in environmental air spaces, including plenum ceilings.

F. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Acceptance Testing Preparation:

1. Test continuity of each circuit.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Required factory-trained personnel site visits:

1. Pre-installation: The system shall be provided with visits from factory trained technician(s) for a pre-installation visit with the contractor prior to system installation.
2. Commissioning and Programming: A second visit shall be included for commissioning and programming of the system including testing of switches and sensors.
3. Owner Training: A third visit shall be provided for owner training after the owner has occupied the building. Minimum four hour training to be video recorded.
4. Owner Re-Training and System Adjustment: A fourth visit 6 months after the owner has occupied the building shall be provided to tweak the system for occupant preferences and for additional training.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 SEQUENCE OF OPERATION

A. Classrooms:

1. The classrooms shall be provided with a control station at the entry door to turn on and dim the zones of lighting in two zones. Zone A to be controlled on/off and dimmed independently of Zone B. Zone B to be controlled on/off and dimmed independently of Zone A. A vacancy sensor shall be provided to turn lights off when no occupancy has been detected for 30 minutes. Where daylight sensors are shown, daylight sensor shall be located in the middle of the room and shall control all fixtures in room.

B. Corridor/Lobbies/Vestibules/Common Areas:

1. The common areas shall be controlled via occupancy sensors and switches. Provide relay to connect to building automation system for on/off control. The dual technology vacancy sensor shall turn the lighting off when no occupancy has been detected for 30 minutes.

C. Restrooms:

1. The large restrooms shall be controlled via occupancy sensors. The dual technology vacancy sensor shall turn the lighting off when no occupancy has been detected for 30 minutes. Small single fixture restrooms shall be controlled via occupancy sensor and set to 5 minutes.

D. Storage Rooms:

1. The storage rooms shall be provided with a low voltage switch at the entry door allowing the occupant to turn lighting on if needed. The dual technology vacancy sensor shall turn the lighting off when no occupancy has been detected for 5 minutes.

E. Large Gathering Space:

1. Provide a touchscreen inside the room and outside of the room to control all zones of lighting as indicated on plans for this area. A vacancy sensor shall be provided to turn lights off when no occupancy has been detected for 30 minutes. Where daylight sensors are shown, daylight sensor shall be located in the middle of the room and shall control all fixtures in room.

3.9 SERVICE AND SUPPORT

A. Provide factory certified field service engineer to make minimum of three site visits to ensure proper system installation and operation under following parameters
   a. Qualifications for factory certified field service engineer:
      1) Minimum experience of 2 years training in the electrical/electronic field.
      2) Certified by the equipment manufacturer on the system installed.
   b. Make first visit prior to installation of wiring. Contractor must schedule meeting Electrical Engineer and Manufacturer representative to review system and functionality prior to installation of wire and equipment.
   c. Make second visit upon completion of installation of Lighting Control System for system start up. Schedule start up with owner and engineer with 2 weeks prior notice.
   d. A total two (2) Owner training session with the electrical contractor, the lighting controls contractor, the factory authorized representative, engineer of record, and the owner (and staff) shall be conducted at the project site. The training session shall be scheduled a minimum of 2 weeks prior. The training session shall not be conducted until the lighting controls system has been programmed and is fully operational.
   e. A total of two (2) walk thrus shall be conducted after completion of construction to assure that the system is fully operational. The walk thrus shall be schedule a minimum of 2 weeks prior and shall be conducted at the request of the owner or engineer of record. In lieu of a formal request from the owner or engineer of record the walk thrus shall be conducted 3 months and 9 months after completion of construction. Reports shall be issued at each walk-thru.

END OF SECTION 265116

SECTION 270610 – VOICE/DATA SYSTEM

PART 1 - GENERAL SPECIFICATIONS

1.1 RELATED DOCUMENTS

A. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

B. The use of proprietary or copyrighted names or reference to patented trade items within this specification or elsewhere in the Contract Documents is meant to establish a standard of quality and performance. In no way does such use establish a restrictive competitive bidding situation, or exclude materials or equipment that is truly equivalent to the standard of quality. All materials and equipment proposed for installation must meet or exceed all specified requirements and be approved. Known equals are listed, but will require cut sheets with performance parameters to be submitted for final approval at least 10 days prior to bid.

1.2 SUMMARY

A. Section Includes:

1. Work Area Outlets
2. 110 Copper Termination Block & Patch Panels
3. Racks, Cabinets and Cable Management
4. Horizontal Distribution Cable
5. Backbone & DAS Cabling Cable
6. Fiber Optic Termination Hardware
7. Patch Cords and Fiber Jumpers
8. Pathways & Penetrations
9. Audio Visual Infrastructure
10. Power (UPS and PDU)
11. Grounding and Bonding
12. Copper Cable Protection Units
13. Firestopping
14. Cable System Identification System

1.3 SCOPE OF WORK

A. The intent of this specification section is to cover the materials and installation of a structured cabling system and termination equipment as outlined herein and as detailed on the drawings. Work shall consist of

1. Work area outlets including faceplates, jacks (voice, data, CATV, A/V), and labels. Boxes and conduit are being provided by Div 26 contractor.

2. Voice and data copper station cabling from work area outlets to telecommunications rooms including termination testing and labeling.
3. Voice and data work area equipment cords.
4. Voice and data horizontal cross-connect jumpers and patch cables including labeling.

B. System Description -- Voice and Data station cabling (copper) system shall consist of:
1. Workstation outlet jacks.
2. Voice and data station cabling as specified herein from each workstation outlet to the termination equipment located in the Main Distribution Frame (MDF) or the Intermediate Distribution Frame (IDF).
3. Station Cable Termination Equipment in each MDF and IDF.
4. Final connections of the station cabling at the workstation outlet jack and the termination equipment in each MDF and IDF.
5. Cross connects / patch cable to connect work area outlets to backbone / network electronics.
6. Testing and labeling.

1.4 REGULATORY REFERENCES:

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials shall be UL or ETL Listed and shall be marked as such. If UL/ETL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL/ETL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1. ANSI/TIA-568.0-D, Generic Communications Cabling for Customer Premises, September 2015
2. ANSI/TIA-568.1-D, Commercial Building Communications Infrastructure Standard September 2015
3. ANSI/TIA-568.2-D, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, September 2018
4. ANSI/TIA-568.3-D, Optical Fiber Cabling Components Standard, September 2016
5. ANSI/TIA–569-D, Telecommunications Pathways and Spaces, November 2015
6. ANSI/TIA–606-C, Administration Standard for Communications Infrastructure, June 2017
7. ANSI/TIA–607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, November 2015

8. ANSI/ TIA–758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, March 2014.
9. ANSI/TIA-1179-A, Healthcare Facilities Telecommunications Infrastructure Standard, August 2017
10. BICSI - TDMM, Building Industries Consulting Services International, Communications Distribution Methods Manual (TDMM) – 13th Edition.
11. National Fire Protection Agency (NFPA – 70)
12. FCC 47 CFR 68
13. NEMA 250
14. NEC 2017
15. ADA, Americans with Disabilities Act

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.5 APPROVED VENDORS

A. The Installation Vendors (Contractors) must at a minimum possess the following qualifications:

1. Be in business a minimum of five (5) years
2. Shall demonstrate satisfaction of sound financial condition and shall be adequately bonded and insured per owner's requirements.
3. Possess those licenses/permits required to perform communications installations in the specified jurisdiction
4. Personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes and regulations. When conflict exists between local and national codes or regulations, the most stringent codes or regulations shall be followed.
5. Must possess and provide proof of current owners insurance certificates
6. Installers with RCDD on staff are preferred, at least one BICSI certified technician required.
7. Must have prior experience with this type of installation or work activity. The customer may, with full cooperation of the contractor, visit client installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through the contractors; however, the contractor's personnel shall not be present during discussions with references. The contractor must provide a minimum of three (3) references of similar jobs, one within the past 6 months and one at least 3 years ago where the same solution was installed.
8. Documentation of ALL certifications to be provided in bid package

9. Outside Plant Projects – will be done by pre approved vendor according to demographic and size of project

1.6 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install a complete telecommunications wiring infrastructure.
2. Furnish, install, and terminate all UTP and Optical Fiber cable
3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Furnish and install j-hooks where needed for the horizontal distribution
7. Furnish and install all materials to build out the MDFs/IDFs as depicted on drawings
8. Telecommunications contractor is responsible for the basket tray in MDFs/IDFs. The basket tray for the horizontal distribution may be done by or in coordination with the electrical contractor
9. Perform link testing (100% of horizontal and/or backbone links/channels) and certification of all components.
10. Furnish test results of all cabling to the owner electronically, listed by each closet, then by workstation ID.
11. Adhere and comply with all requirements of Manufacturer Certification.
12. Provide owner training and documentation. (Testing documentation and As-built drawings)

1.7 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:

1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
3. No substitutions/alternatives from the manufacturers listed in this document will be permitted. No substituted materials shall be installed except by written approval.
4. Product Data: For each type of product indicated.
    a. Submittals shall include manufacturer's data sheets (cut sheets) and be accompanied by a detailed bill of material, including part numbers and quantities.
5. Shop Drawings:

a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
b. Wiring diagrams to show typical wiring schematics including the following:
    1) Cross-connects.
    2) Patch panels.
    3) Patch cords.
c. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
d. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
    1) Vertical and horizontal offsets and transitions.
    2) Clearances for access above and to side of cable trays.
    3) Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    4) Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

6. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
7. Source quality-control reports.
8. Field quality-control reports.
9. Maintenance Data: For connectors to include in maintenance manuals.

B. Work shall not proceed without the Owner's approval of the submitted items.

1.8 QUALITY ASSURANCE

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not. All installers must be employees of the contractor.

1.9 DELIVERY, STORAGE AND HANDLING

A. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from theft, vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.
B. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.10 DRAWINGS

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
B. The contractor shall verify all dimensions at the site and be responsible for their accuracy.
C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work

1.11 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers.
   1. Meet jointly with telecommunications and LAN equipment suppliers, Engineer, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust arrangements and locations of racks, sleeves, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of utility demarcation, telephone and LAN equipment.
B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

A. Due to the nature and type of communications all products and solutions in this document have a standard of quality listed. Substitutions are listed, but products MUST demonstrate performance equivalency.

2.2 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
   1. A minimum of two (2) modular jacks unless specified. Additional copper cables as necessary.
   2. A blank filler will be installed when extra ports are not used.
   3. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.
   4. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA–606-C standard specifications. Hand printed labels shall not be accepted.

C. Faceplates: Standard of quality is Legrand Part # OR-403STJ14 (4 port) or OR-403STJ12 (2 port) The faceplates shall:
   1. Be of the style as appropriate to fit the modular jack used
   2. Have mounting screws located under recessed designation windows.
   3. Comply with ANSI/TIA 606-C work area labeling standard.
   4. Workstation Outlets: Connector assemblies mounted in faceplate. Provide number of ports as shown on the Drawings.
   5. Retain one of first two subparagraphs below, or retain both as required to match Division 26 Section "Wiring Devices."
   6. Plastic Faceplate: High-impact plastic.
   7. For use with snap-in jacks accommodating any combination of UTP, F/UTP, optical fiber, and coaxial work area cords.
   8. Acceptable substitutions are Systimax and Panduit

D. Voice / Data Jacks: Standard of quality is Legrand Cat 6 for voice/data; Cat 6 for wireless access points

   1. Cat 6 Jacks: 100-ohm, unshielded balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.2-D up to 250 MHz.
   2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
   3. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
   4. The modular jack shall be center tuned to category 6 test specifications.

Part Number	Description
OR-HDJ6-36	Legrand Category 6 T568A/B High Density (HD) Jack Blue (Data)
OR-HDJ6	Legrand Category 6 T568A/B High Density (HD) Jack Fog White (Voice)

   5. Cat 6 jacks (qty 1) to be used for each Wireless Access Points (to accommodate for speeds in excess of 1 Gigabit transmission).

   6. Jacks: 100-ohm, unshielded balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.2-D up to 500 MHz.
   7. The modular jack shall be backwards compatible to Category 3, 5e and 6.
   8. The Wireless Access Point jacks shall be terminated in a 2-port surface mount box.
   9. The modular jack shall be center tuned to category 6 test specifications.

Part Number	Description
OR-HDJ6-36	Legrand Category 6 T568A/B High Density (HD) Jack Blue (Data)

   10. Acceptable substitutions are Systimax and Panduit

2.3 110 COPPER TERMINATION BLOCK

A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips.

B. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire.

C. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

D. Standard of quality: Legrand

E. 110 Block Kits shall:
   1. include both the wiring block in a 50, 100 and 300 pair footprint and the connecting block C6110C5
   2. be manufactured using fire retardant molded plastic.
   3. support termination of 22-24 AWG solid conductor
   4. wiring block shall contain back openings for the feed through of cable
   5. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
   6. shall use standard termination practice requiring a single conductor 110 impact tool
   7. have termination hardware that maintains the paired construction of the cable to facilitate minimum untwisting of the wires.
   8. be backwards compatible to category 3, 5 and 5e

F. 110 Cross-Connect System Backboard Channels Shall
   1. be available in 300 and 900 pair sizes.
   2. allow the mounting of 110 100-pair blocks without legs.
   3. include bottom trough and grounding bar.
   4. be wall mountable.
   5. be of cold roll steel construction.

G. 110 Wall Mount Vertical Trough Shall
   1. be available in single channel or dual channel configurations.
   2. in dual channel configuration shall be used to provide separation for different wiring media.
   3. be available in 300 pair and 900 pair sizes.
   4. be wall mountable.
   5. be used with wall mountable backboard channels. Acceptable configurations include a 300 pair and a 900 pair.
   6. be of cold roll steel construction.

Note: Project may require horizontal analog and backbone cables to be terminated on patch panels in IDF/MDF's. Contact Telecom Representative for details.

2.4 MODULAR PATCH PANELS

A. The Modular Patch Panels shall
   1. Meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
   2. be backward compatible to category 3, 5 and 5e
   3. be center tuned to category 6 test specifications
   4. Standard of Quality is Legrand

Part Number	Description
OR-PSAHJU48	48 Port unloaded 2RU Angled Panel (for HD Jacks)

   5. Acceptable Substitutions are Systimax or Panduit

2.5 RACKS, CABINETS, AND CABLE MANAGEMENT

The equipment rack shall provide vertical cable management and support for the patch cords at the front and back of the rack. Waterfall cable management shall be provided at the top of the rack to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack.

A. Free-Standing Rack shall:
   1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA 568-D.
   2. provide pre-drilled base for floor attachment of rack.
   3. be available in standard color of black or white.
   4. Provide channels with 10" depth for routing of horizontal cable
   5. Standard of quality for 2 and 4 post racks shall be Legrand.

Part Number	Description
OR-MM20710-B	Black 2 Post Rack, 7' high with 10" channel depth
OR-MM20742ADJ12-B	Adjustable 4 Post MM Rack, 7' high with tapped mounting holes
OR- MM20742ADJ38-B	Adjustable 4 Post MM Rack, 7' high with square mounting holes

   6. Acceptable substitutions are Tripp Lite and Middle Atlantic

B. The vertical and horizontal cable management shall be utilized and installed with the 2 and 4 post racks.

1. They shall include snap on covers/doors that can swing either direction.
2. Standard of quality for cable management shall be Legrand MM20 for vertical and SHMC series for horizontal.

Part Number	Description
OR-MM20VMD706-B	Single Sided 6” Vertical Cable Management with door, 6” W x 10.25” D x 7’ H (for end of row or single racks)
OR- MM20VMD710-B	Single Sided Vertical Cable Management with door,10.5” W x 15”D x 7’ H (for between racks)
OR-SHMC2RU	2U Horizontal cable manager to be used between patch panels and/or switch gear
OR-SHMC4RU	4U Horizontal cable manager to be used to pass patch cords from one side of the rack to the other

3. Acceptable substitutions are Tripp Lite and Middle Atlantic

C. Wall Mounted Cabinet shall:
1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA 568-D.
2. have wall mount braces with locator posts for easy wall mounting.
3. have side access points that allow for access to manage/install distribution cables in the vertical channels.
4. be lockable.
5. contain integrated vertical cable management
6. The standard of quality for wall mount cabinet shall be Legrand:

Part Number	Description
SWM12RUPL-26-26	26”W x 25”H x 28”D, plexi-glass door 12 RU; 200 lbs*
SWM26RUPL-26-26	26”W x 28”D x 49.5”H, plexi-glass door 26 RU; 300 lbs*

*weight capacity

7. Acceptable substitutions are Tripp Lite and Middle Atlantic

D. Free-Standing Cabinet shall have full flat mesh front door with locking swing handles
1. Standard of quality is Legrand

Part Number	Description
OR-QC422442	Legrand Server Cabinet, free-standing, 42U, 24” W, 42”D, with side panels (cabinet accessories to be specified)
OR-QC422942	Legrand Network Cabinet, free-standing, 42 RU, 29.5” W, 42” D with side panels (cabinet accessories to be specified).

2. Acceptable substitutions are Middle Atlantic and Tripp Lite

2.6 HORIZONTAL DISTRIBUTION CABLE

A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper), or patch/splice cabinets (fiber) in their respective MDF or IDF as specified on the drawings.

B. Category 6 cable will be utilized for standard voice and data drops, and Category 6 cable will be utilized for wireless access points.

C. Copper or fiber cable that offers EPDs (Environmental Product Declaration) and / or HPDs (Health Product Declaration) to apply toward LEED certification are PREFERRED.

1. Products covered by EPDs and HPDs contribute towards one (1) point each in the Material and Resources credit (MRc) category for projects pursuing those credits

2. Products that have both EPDs and HPDs will effectively contribute towards two (2) separate credits in the MR category

D. 100 OHM Category 6 UTP with fire-resistant thermoplastic jacket with separator or divider between pairs.

1. Physical Characteristics:
   a. Plenum
      1) Insulation FEP
      2) Jacket: FR, low smoke PVC
      3) Nominal Velocity of Propagation: 73
   b. Non Plenum
      1) Insulation: Polyolefin
      2) Jacket: FR PVC
      3) Nominal Velocity of Propagation: 70
   c. Solid annealed copper conductors
   d. 23 AWG copper conductors
   e. Low-dielectric thermoplastic insulation
   f. Pair-separator for improved performance
   g. Characteristic Impedance: 100 ± 15 Ohms
   h. Comply with UL 444
   i. Comply with NFPA 262
   j. Comply with ICEA S-90-661 for mechanical properties.
   k. Comply with ANSI/TIA-568.2-D for Category 6 UTP cables.
   l. Verified for Category 6 performance by an NRTL
   m. RoHS compliant materials

2. Performance Characteristics:
   a. Guaranteed electrical performance up to 400 MHz
   b. Guaranteed 3 dB margin over ANSI/TIA-568.2-D requirements for NEXT and PSNEXT
   c. Guaranteed 4 dB margin over ANSI/TIA-568.2-D calculated requirements for ACR and PSACR
   d. Printed with unique alpha-numeric code for each package of product

e. Printed in both feet and meters with the units of length decrementing to indicate the amount of cable remaining in the box.
f. Tip colors shall be a lighter version of the ring color.
g. 4 pair UTP for Wireless Access Points for speeds in excess of 1 Gigabit transmission (see section F for 6 specification): Cat 6 with isolation wrap (no ground required) or actual shield (needs grounding).

3. Design Make:

a. Standard of quality for Cat 6 is Superior Essex Datagain Cat 6 enhanced UTP.

Plenum Part Number	Description
66-240-2B	Data / Blue / CMP

Non-Plenum Part Number	Description
66-240-2A	Data / Blue / CMR

E. 100 OHM Category 6 UTP with fire-resistant thermoplastic jacket with separator or divider between pairs and isolation wrap.

1. Physical Characteristics:
   a. Plenum
      1) Insulation FEP
      2) Jacket: FR, low smoke PVC
      3) Nominal Velocity of Propagation: 73
   b. Non Plenum
      1) Insulation: Polyolefin
      2) Jacket: FR PVC
      3) Nominal Velocity of Propagation: 70
   c. Solid annealed copper conductors
   d. 23 AWG copper conductors
   e. Low-dielectric thermoplastic insulation
   f. Pair-separator for improved performance
   g. Characteristic Impedance: 100 ± 15 Ohms
   h. Comply with UL 444
   i. Comply with NFPA 262
   j. Comply with ICEA S-90-661 for mechanical properties.
   k. Comply with ANSI/TIA-568-C.2 for Category 6 UTP cables.
   l. Verified for Category 6 performance by an NRTL
   m. RoHS compliant materials

2. Performance Characteristics:
   a. Guaranteed electrical performance up to 400 MHz
   b. Guaranteed 3 dB margin over ANSI/TIA-568.2-D requirements for NEXT and PSNEXT
   c. Guaranteed 4 dB margin over ANSI/TIA-568.2-D calculated requirements for ACR and PSACR
   d. Printed with unique alpha-numeric code for each package of product

e. Printed in both feet and meters with the units of length decrementing to indicate the amount of cable remaining in the box.
f. Tip colors shall be a lighter version of the ring color.
g. 4 pair UTP for Wireless Access Points for speeds in excess of 1 Gigabit transmission: Cat 6 with isolation wrap (no ground required) or actual shield (needs grounding).

2.7 BACKBONE CABLE

A. Intrabuilding multipair unshielded twisted pair

1. General purpose 25 pair plenum Cat 5e (Superior Essex cmp part #51-478-48)
2. For higher pair counts when Cat 3 is acceptable; 100 pair category 3 plenum unshielded twisted pair (Superior Essex Category 3 cmp part number 18-799-36) may be used.

B. Fiber Optic Cables

1. Fiber cable that offers EPDs (Environmental Product Declaration) and / or HPDs (Health Product Declaration) to apply toward LEED certification are PREFERRED.

2. Products covered by EPDs and HPDs contribute towards one (1) point each in the Material and Resources credit (MRc) category for projects pursuing those credits

3. Products that have both EPDs and HPDs will effectively contribute towards two (2) separate credits in the MR category

4. Multimode: Armored Optical Fiber Plenum (OFCP) Tight Buffered With 10 Gigabit OM3 Laser Optimized 50/125 Optical Fibers
   a. Each Multimode Fiber shall be:

      1) Graded-index optical fiber wave-guide with nominal 50/125µm-core/cladding diameter.
      2) The fiber shall comply with the latest revision of ANSI/TIA-492AAAC.
      3) Attenuation shall be measured in accordance with ANSI/TIA-455-78.
      4) Information transmission capacity shall be measured in accordance with ANSI/TIA-455-204 or –455-220.
      5) The measurements shall be performed at 23°C $\pm$ 5°C.
      6) Maximum attenuation dB/km @ 850/1300 nm: 3.5/1.5
      7) Bandwidth: 1500 MHz-km @ 850nm for overfilled launch,
      8) Bandwidth 500 MHz-km @ 1300nm.
      9) Optical Fiber shall be laser optimized and guaranteed for 40/100 Gigabit Ethernet distances of 100 meters
      10) Optical Fiber shall be laser optimized and guaranteed for 10 Gigabit Ethernet distances of 300m/300m for 850nm and 1300nm respectively
      11) Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm respectively

   b. Physical Characteristics:

1) Shall be suitable for use in indoor applications.
2) Shall be suitable for use in risers, plenums and horizontal applications.
3) Shall be available with a fiber strand count range from 6 to 144.
4) Shall meet NFPA 626
5) Shall comply with Telcordia GR-409.
6) Shall comply with the requirements of ICEA S-83-596.
7) Buffered fibers shall be color coded in accordance with TIA-598 with an overall aqua jacket.
8) Shall have a central strength member
9) Suitable for operation between -20°C to +75°C
10) Shall meet UL 1569, UL 1651
11) Shall be RoHS compliant
12) Shall have spiral wrapped aluminum armor and outer jacket

c. Design Make:

1) Standard of quality for Premise Distribution optical fiber cable with OM3 laser optimized 50/125 micron multi mode fiber is Superior Essex, part numbers below:

Part Number	Description
L4006N401	6 strand armored laser optimized 50 micron multi mode

2) Acceptable Substitutions are Systimax and Corning

C. DAS (Distributed Antenna System)

1. Regardless of which DAS active equipment is to be installed, (Andrews, Mobile Access, Tyco Electronics, etc) standard of quality for copper 6 or helix copper DAS cabling & connectors as well as fiber shall be Superior Essex & Legrand.
2. DAS Integrator will be required to work with certified cabling contractor for pulling of and termination of all DAS copper and fiber cabling infrastructure.

a. RF Feeder Infrastructure

1) Cable
a) LHF Series – Low Loss High Flexible Foam Dielectric
b) HFSC Series – Super Flexible Foam Dielectric
c) FTTA – Fiber to the Antenna

2) Jumpers
d) Available in ⅜ inch and ½ inch diameters, jumper cables are used in areas that require extremely small bending radius, such as between main feeders and antennas or between main feeders and RF equipment

3) Connectors
e) DIN Series for LHF and HFSC

f) N Series for LHF and HFSC

b. In Building Infrastructure

1) Cable – Available in Plenum or Riser
   g) DAS Hybrid – Fiber + Copper
   h) LHF Riser – Low Loss High Flexible Foam Dielectric
   i) LHF Plenum – Low Loss High Flexible Air Dielectric
   j) HFSC Riser – Super Flexible Foam Dielectric
   k) HFSC Plenum – Super Flexible Air Dielectric

2) Jumpers Available in Plenum or Riser
   a) Available in ½ inch diameters, jumper cables are used in areas that require an extremely small bending radius between main feeders and antennas or between main feeders and RF equipment.

3) Connectors
   a) DIN Series for LHF and HFSC
   b) N Series for LHF and HFSC

2.8 FIBER OPTIC TERMINATION HARDWARE

A. FIBER OPTIC ENCLOSURES
1. Fiber optic termination hardware is rack mountable, lockable, and holds various coupler panels based on density requirements.
2. Fusion Splicing (splice cassettes, pigtails, or splice on connectors) shall be the preferred termination style for any new installations, unless otherwise stated.
3. Internal lighting for ease of use
4. Pivot arms for fiber slack management
5. Standard of quality is Legrand
6. Acceptable Substitutions are Systimax and Corning
7. Fiber Enclosures

Part Number	Description
OR-INFC01U-M4	1U combo splice/patch enclosure, holds 4 adapter panels,
OR-INFC02U-M4	2U combo splice/patch enclosure, holds 8 adapter panels,
OR-INFC04U-M4	4U combo splice/patch enclosure, holds 16 adapter panels,

B. Splice cassettes (used instead of standard fiber optic adaptor panels)

Part Number	Description
OR-M4LCD12-50ES2A1	Fusion Splice Cassette 50um Multimode 12 fiber LC
OR-M4LCD12-09S1A1	Fusion Splice Cassette Singlemode 12 fiber LC

Fan Out Kits (if needed to build up 250um fiber before termination)

Part Number	Description

OR-61500858	Breakout Kit 12 fiber

C. FIBER OPTIC ADAPTER PANELS (used w/ pigtail or splice on connector terminations)

Legrand Adapter panels will be of 6 duplex LC connectors (12 fibers) for multimode connections.

Part Number	Description
OR-HDFP-LCD12LC	6-LC Duplex multimode, aqua adapters, ceramic sleeve 12 fiber
OR-HDFP-BLANK	Blank Filler modules

D. FIBER OPTIC PIGTAILS / CONNECTORS

1. For fiber splicing, utilize Legrand 6 strand LC fiber pigtails or fusion splice on connectors. Legrand part numbers:

2. When mechanical terminations are acceptable for MAC work, Utilize Legrand LC multimode (OR-205KNT9GA-50T) Infinium Connectors for standard terminations.

Part Number	Description
OR-806-0L1-009-55L	6 strand Multimode LC fusion splice pigtail
OR-205KNF9FA-50T	Multi Mode fusion splice on connector
OR-205KNT9GA-50T	LC Multimode Infinium mechanical connectors

3. Acceptable Substitutions are Systimax and Corning

2.9 PATCH CORDS & FIBER JUMPERS

A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA 568-D for patch cord testing.

B. Copper (UTP) patch cords shall:

1. Standard of quality is Legrand Cat 6; OR-MC6-zz-xx (zz=length; xx = color).
2. Standard lengths include, 3 ft, 5 ft, 7 ft, 9 ft, 10 ft, 15 ft.
3. use 8 position connector with impedance matched contacts and designed using dual reactance.
4. Be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA 568.2-D.
5. Meet TIA category 6 component specifications in ANSI/TIA 568.2-D
6. 100% factory tested to meet category 6 performance and
7. ETL or any other nationally recognized 3rd party verification
8. Be capable of universal T568A or T568B wiring schemes.
9. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
10. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief

11. Be backwards compatible to Category 3, 5 and 5e
12. Be manufactured by an ISO 9001 registered company.
13. Provide one 10 foot Cat6 patch cord for every switch port.
14. Provide one 7 foot Cat6 patch cord for every workstation phone and computer.
15. Provide one 3 foot Cat6 patch cord for every wireless access point
16. The contractor shall include the labor cost in the quote to install all patch cords in the wiring closets as well as the workstation and wireless access points.
17. Cat 6 copper patch cords for Wireless Access Points for speeds in excess of 1 Gigabit transmission: Cat 6 Standard of Quality is Legrand. OR-MC6-zz-xx
18. Acceptable substitutions are Quiktron, Systimax and Panduit

C. Fiber jumper cords shall:

1. Standard of quality for Multimode duplex 5 meter 50 um 10 gig aqua for multimode applications is Legrand LC to LC (OR-P1DF2LRGZGZ005M).
2. Provide four (4) duplex LC-LC 5 meter jumpers per switch in each TR.
3. Provide two (2) duplex LC-LC 5 meter jumpers per rack in each TR.
4. Acceptable substitutions are Quiktron, Systimax and Corning

2.10 PATHWAYS & PENETRATIONS

A. Conduit

1. All conduit work shall meet the requirements of the National Electrical Code.
2. All voice, data and video wiring inside rooms shall be protected by metallic conduit or other means such as Legrand/Wiremold or troughs in the floor. Aluminum is not acceptable in caustic environments. EMT conduit shall be used for all interior wiring. All conduits are to be concealed.
3. No more than an equivalent of two 90-degree bends are allowed in a run between junction boxes or pull boxes.
4. Entrance to junction boxes or distribution panels shall be adjacent to the corners.
5. In major renovation and new construction projects where the MDF/IDF are not in alignment, the contract shall include provisions for installation of four riser conduits (4 inches minimum diameter) from the MDF to each IDF. A pull string and appropriate junction pull box shall also be provided in each conduit run to facilitate future installation of cable(s). Maxcell fabric innerduct should be used to create multiple pathways in each 4” conduit.
6. All conduits in slab shall be a minimum of 1 inch. All exceptions shall be determined during the design stage of the project and shall be subject to the approval of the engineer.
7. All sleeves must protrude 4 inches AFF and below and be capped at both ends. Coordinate with customer for the number of conduits entering the facility. All sleeves must be bonded to the telecommunications bonding system.
8. No horizontal conduit run shall be more than 100 feet between pull boxes.

9. Pull boxes must be installed every 180 degrees or 100 feet of the conduit run. All conduit stubs must be bonded to the telecommunications grounding system.

B. Conduit/Raceway Capacity

1. Conduit shall be sized using industry standard guidelines for telecommunications distribution methods. Guidelines can be found in the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual and/or cabling manufacturers' guidelines. Utilize Maxcell fabric innerduct to maximize conduit fills

Part Number / Series	Description
MXC4003 series	Standard 4" 3 Cell fabric innerduct
MXP4003 series	Plenum 4" 3 Cell fabric innerduct
MXR4003 series	Riser 4" 3 Cell fabric innerduct
MXD4003 series	Detectable 4" 3 Cell fabric innerduct
MXC3456 series	Standard 3" 3 Cell fabric innerduct
MXP3456 series	Plenum 3" 3 Cell fabric innerduct
MXR3456 series	Riser 3" 3 Cell fabric innerduct
MXD3456 series	Detectable 3" 3 Cell fabric innerduct

C. Cable Trays

1. Standard of quality for basket tray is Cablofil.

2. All cable trays shall be designed to accommodate all types of cabling. Note that installation shall be in non-return air plenum space only. All telecommunications pathways (Caddy J-hooks, basket tray or Legrand/Wiremold raceways) shall be used for communications medium (voice, data and fiber optic cabling) only.

3. The minimum dimensions for a cable tray shall be 12 inches wide and 4 inches deep. The tray must consist of continuous, rigid, welded steel or stainless steel wire mesh cable management system. The cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories. Wire mesh cable tray will have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers. Basket tray shall be spliced using EDRNs on the sides as well as an SWK washer/nut in the bottom of the tray.

4. Contract documents shall show cross section of the communication wire way or cable tray. The drawing must show reference to other utilities in the building. All sections of the cable tray must be bonded together with approved bonding methods and devices. For installation of other types of "approved" low voltage cables in the cable tray, a separate tray or at minimum a divider in the basket tray to prevent interference from unshielded cables is required.

5. Supports for cable trays larger than 12 inches in width are to be installed according to the manufacturer specifications. A single support is not acceptable. All supports are to be fastened to the building structure above. If the cable tray will be of a wall mount type, it

must be installed properly to provide proper permanent support at trays maximum capacity.

6. Radius Drop outs shall be used whenever multiple cables are exiting the tray.

7. STI's EZ Path's (44, 33 or 22 series) shall be used in conjunction with the tray whenever cabling is going through a fire rated wall.

8. Cable trays must maintain a minimum of 6-inch clearance from obstructions above the tray and a minimum of 8 feet AFF. Trays are to provide access via the most direct path to all communications outlets on the floor.

9. Install sweeping factory 90's for all turns. Use end-of tray terminations where wire drops down to walls to prevent abrasions and cuts from metal tray edges. Use a trapeze supported cable tray mounting method suspended by manufacturer recommended size all-thread. Fasten all-thread to ceiling anchors, allowing no bends in all-thread. Support the cable tray in this manner at every section-to-section junction and at 5 feet to 6 feet intervals (mid span) between joints. Whenever possible, the tray should be no closer than 6 inches from the structural ceiling, ducts or pipes, considering all other possible obstructions. A minimum of 5 inches distance from lighting, especially fluorescent lighting, is desired.

10. Coordinate layout and installation of cable tray with other trades. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect. Basket tray installation in the TRs shall be installed as depicted on the drawings by the Telecommunications Contractor. The basket tray that is to be installed for the horizontal and backbone distribution will be provided and installed by the electrical contractor.

11. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

12. Refer to the drawings for the size and location of the tray to be installed.

13. Ground cable trays at end of continuous run. Ground continuous cable tray runs every 60 feet. Cable trays that are not UL Classified will be grounded per NEC requirements and manufacturer recommendations.

14. Ground cable trays against fault current, noise, lightning, and electromagnetic interference by mounting grounding wire to each 10' cable tray section with grounding clamp.

D. Open Top Cable Supports (J-hooks)

1. Standard of quality is Erico/Caddy HP series of j-hook

2. All open top cable supports (J-hooks) must be suspended from or attached to the structural ceiling or walls with hardware or other installation aids from Caddy specifically designed to support their weight. When used, Caddy J hooks shall be located on 48 to 60 inch centers to adequately support and distribute the cables weight. These types of supports may typically hold up to fifty 0.25-inch diameter cables.
3. No other cables shall be run in the same j-hooks along with the voice and data cables. A separate painted (white, red, blue, green) Caddy j-hook system must be provided to facilitate the installation of other low voltage cabling.
4. For larger quantities of cables that convene at the Telecommunications Closet, provide Cablofil cable trays or other special ERICO/CADDY supports that are specifically designed to support the required cable weight and volume.
5. No plastic j-hooks will be allowed.
6. Substituted material must demonstrate product equivalency.

E. Floor Mounted Assemblies (Floor Boxes and Poke Throughs)

1. All Floor Mounted Assemblies including floor boxes, poke through, floor outlets, floor mounted whips, tombstones, etc. shall be sized using industry standard guidelines for telecommunications distribution methods; specifically relating to cable fill ratios and limitations. Guidelines can be found in the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual and/or through individual cabling manufacturers' installation guidelines.

2. Standard of quality for all Poke-throughs and floor boxes is the Evolution series from Legrand/Wiremold.

3. Floor boxes Shall:

    a. be used in concrete, raised floor and wood floor applications and are fully adjustable both pre and post concrete pour.
    b. have removable dividers and a tunnel feature that allows all compartments to be connected.
    c. have removable modules through the top or back of the floor box.
    d. The floor box hinge must is able to open to a full 180^{o} and lie flat on the floor surface providing easy access to interior modules. Cable egress doors lock in position when open and will automatically close around wires to protect cabling and avoid tripping hazards.
    e. accept single, double or triple wall plates as well as accommodate power, communications and A/V devices.
    f. be designed to maintain up to a 2 hour fire rating.

4. Poke throughs Shall
    a. provide the interface between power, communication and audio/ visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power communication and/or A/V device outlets are required.
    b. provide recessed device outlets that will not obstruct the floor area. The poke-thru device shall be compatible with the complete line of workstation connectivity outlets and modular inserts.

c. permit all wiring to be completed at floor level.

1) The 6AT, and 6ATCFF units shall mount in a 6" [152mm] cored hole, actual 6 1/16" [154mm] core hole.
2) The 8AT units shall mount in an 8" [203mm] cored hole, actual 8 1/16" [205mm] core hole. Use is defined by the UL Fire Resistance Directory as a minimum spacing of "2 ft. [610mm] on center and not more than one device per each 65 sq. ft. [6m2] of floor area in each span."

F. Wall Boxes (A/V, Power, Data behind flat screens)

1. Standard of quality for all wall boxes is the Evolution series from Legrand/Wiremold.
2. Wall Boxes Shall:
   a. be used for TVs, Monitors, & Digital Signage for use in new construction and renovation construction projects.
   b. be compatible with complete line of workstation connectivity outlets and modular inserts, and most audio/video manufacturers' products.
   c. provide the interface between power, communication and audio/video (A/V) cabling new construction and renovation location where power and communication and/or A/V device outlets are required.
   d. provide recessed device outlets that will not obstruct the wall area.
   e. permit all wiring to be completed at box level

G. Conference/Collaboration/Training Room Solutions (Table Boxes; Cable Retractors, Under-table cable management)

1. Standard of quality is Wiremold/Legrand Integreat series

2. Table Boxes / Table penetrations:
   a. Cover: Brushed, anodized aluminum cover in a black or aluminum finish with beveled edges and "soft-touch" handle.

      1) Cover contains a "pocket" door which fully recesses into the box when open, giving access to connections without obstructing work surface. A finishing plate hides hardware on activation surface and permits labeling of the AVIP plates.

      2) Cover flange allows for 1/4-inch [6.4mm] of forgiveness in the cut out opening.
   b. Activation Surface: Adjustable downward in 1/2-inch [12.7mm] increments, from one (1) inch to four (4) inches [25mm to 102mm] to allow cover to close even when large style connectors are used.
   c. Provide table boxes with a 12 foot SJT cord for easy connection to electrical infrastructure.
   d. Supply tables boxes with a cable grommet kit that can accommodate up to eight (8) pull out connections. Boxes shall also be capable of accepting up to five (5) Wiremold AVIP connectors.
   e. Provide table boxes with two (2) 15 amp receptacles in top compartment and one (1) 15 amp receptacle on underside of box.

3. Cable Retractors: InteGreat™ Series cable retractors; mounts directly to InteGreat™ Series A/V Table Box or underside of conference room table using a horizontal mounting bracket.
    a. Cable Retractors with Category 6 Cable: Catalog No. TBCRCAT6; loaded with 12 feet [3.66m] of Cat6A cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
    b. Cable Retractors with VGA Cable: Catalog No. TBCRVGA; loaded with 12 feet [3.66m] of VGA cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
    c. Cable Retractors with HDMI Cable: Catalog No. TBCRHDMI; loaded with 12 feet [3.66m] of HDMI cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side. Provide input side with mounting tab that allows installer to cable tie HDMI to retractor to minimize chances of loose connections.
    d. Cable Retractors with 3.5MM Audio Cable: Catalog No. TBCR3.5MM; loaded with 12 feet [3.66m] of audio cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
    e. Cable Retractor Horizontal Mounting Brackets: Catalog No. TBCRHMK; permits retractor to mount horizontally under conference room table, enabling cable access through a table grommet. Multiple retractors can be mounted to each other by attaching the mounting brackets to each other.

4. Under Table Cable Management Kit: InteGreat™ Series under table cable management kit provides clean cable management for power, communication and A/V cables on horizontal underside of table.
    a. Under Table Cable Management Kit: Catalog No. UTCM5; includes five (5) feet [1.524mm] length of divided base, five (5) feet [1.524mm] length of mounting hinge rail and four (4) latching clips; black, nonmetallic construction.
    b. Transition Channels: InteGreat™ Series transition channels continue cable management and protection from underside of the table to the floor, where cables can gain access to building infrastructure. Channel fits directly into under table cable management kit on underside of table and mates with poke-thru device or over floor raceway for smooth transition to building infrastructure.
    c. Transition Channels: Catalog No. MRTC; consists of aluminum center spline with steel mounting plate and four (4) screws, black aluminum side channels, black nonmetallic bottom boot and two (2) black nonmetallic transition covers.

Part Number / Series	Description
EFB Series	Evolution Floor Box
6AT Series	Evolution Poke Throughs 6”
8AT Series	Evolution Poke Throughs 8”
EFSB2 Series	Evolution 2 Gang Wall Box
EFSB4 Series	Evolution 4 Gang Wall Box
TB Series	Integreat A/V Table Box
TBCRCAT6	InteGreat Cable Retractor Cat 6

TBCRVGA	InteGreat Cable Retractor VGA
TBCRHDMI	InteGreat Cable Retractor HDMI
UTCM5	InteGreat Under Table Cable Mgmt.
MRTC	InteGreat Transition Channel

5. Substituted materials for floor boxes, poke throughs, wall boxes and conference room applications must be able to demonstrate product equivalency.

2.11 AUDIO/VISUAL INFRASTRUCTURE

For applications involving patient rooms, classrooms, conference rooms, collaborative work spaces, etc., that require HDMI, USB, Display Port, VGA, and other digital and/or analog A/V connections, the cabling infrastructure shall utilize Quiktron as the standard of quality. Substituted materials for all A/V applications must be able to demonstrate product equivalency.

A. HDMI-to-HDMI, HDMI-to-DVI, DVI-to-HDMI and DVI-to-DVI

1. Direct (native signal) connections (point-to-point) shall be HDMI High Speed Rated and designed and tested to handle video resolutions of 1920 x 1080p or greater, including advanced display technologies such as 4K, UltraHD, 3D, and Deep Color
2. Direct (native signal) connections (point-to-point) shall not exceed 20 meters in total combined length and may be CMP, CMR, CM, CL3 or CL2 rated as appropriate to the installation and applicable code

1. Connections less than 20 meters in total combined length shall be a certified copper cable or connectivity solution, except when:
   a. Direct (native signal) connections (point-to-point) that require a form factor different than that typically available in a quality copper assembly may leverage the selection of “media conversion” and other solutions offered for such situations, and will include as acceptable alternatives RapidRun™, RapidRun Optical™ HDMI-over-Coax, HDBaseT, HDMI-over-UTP.

2. Connections greater than 20 meters in total combined length shall be certified connectivity solutions, as best serves the form factor needed, from the selection defined below:
   a. RapidRun Optical™
   b. HDMI-over-UTP, HDMI w/ serial RS232-over-UTP, HDMI w/ VGA-over-UTP, HDMI w/ VGA and Stereo Audio-over-UTP, HDMI w/ VGA, Audio, and Composite Video-over-UTP or HDMI-over-Coax
3. In installations where it is determined that insufficient bus power (Vbus) exists for reliable performance, the Quiktron HDMI Power Inserter may be used

B. Universal Serial Bus (USB)

1. USB connections (point-to-point) less than 5 meters total length shall be Quiktron USB 2.0 rated for all applications
    a. Systems specifically requiring USB 3.0 or faster speed transfer ability (SuperSpeed or SuperSpeed Plus) may include Quiktron USB 3.0 cables, which may not exceed 3 meters total combined length
2. USB connections (point-to-point) more than 5 meters in total length shall be Quiktron connectivity solutions, as best serves the form factor needed for installation, from the selection defined below:
    a. USB connections greater than 5 meters but less than 12 meters in length shall be Quiktron USB Active Extender Cable solutions, or
    b. USB connections greater than 5 meters but less than 100 meters in length shall be Quiktron USB 1.1 over Cat 5 SuperBooster or Quiktron USB 2.0 over Cat 5 SuperBooster solutions as required by the system design
3. USB external hubs shall be Quiktron USB 3.0 SuperSpeed rated with dedicated power supply (powered hubs)
    a. No more than four (4) tiers of USB connectivity shall be allowed without inclusion of a powered hub to restore full USB bus (V_{bus}) power for proper operation of downstream devices and links

C. DisplayPort

1. DisplayPort cables shall be Quiktron DisplayPort rated 1.1 performance or greater, and
2. DisplayPort point-to-point direct connections shall not be more than 10 meters in total combined length
3. DisplayPort point-to-point direct connections greater than 10 meters in total combined length shall be transported via DisplayPort-to-HDMI conversion (dongle) and shall then use an HDMI connection solution approved for connections of HDMI signals beyond 20 meters as detailed above (see HDMI), or
4. DisplayPort point-to-point direct connections greater than 10 meters in length shall be transported via RapidRun Optical

D. D-sub 15, mini sub D15, mini D15, DB-15, HDB-15, HD-15 or HD15, hereafter collectively called VGA

1. VGA direct (native signal) connections (point-to-point) shall be designed and tested to support video resolutions of up to QXGA (2048x1536) and pass Extended Display Identification Data (EDID) signals
2. VGA direct (native signal) connections (point-to-point) shall not exceed 50 meters in total combined length without appropriate signal conditioning and may be CMP, CMR, CM, CL3 or CL2 rated as appropriate to the installation and applicable code
3. VGA direct (native signal) connections (point-to-point) shall be certified connectivity solutions, as best serves the form factor needed, from the selection defined below:
    a. RapidRun™
    b. RapidRun Optical ™

c. Select or Select w/audio
d. Premium Shielded or Premium Shielded w/audio

2.12 POWER – UPS AND PDU OPTIONS

A. UPS (Uninterrupted Power Supply)

1. Standard of quality for Communications Rack Online UPS is Tripp Lite. Substituted material must be able to demonstrate product equality

2. Provide true online battery back-up, power conditioning UPS, rack mounted in each TR to serve network electronics as indicated on the drawings. UPS shall have the following features:
   a. 5000/3000/2200/1500 VA capacity as indicated
   b. Output operating range—280V (5000VA)/120V (<3000VA) nominal
   c. Communications—Unit shall provide an Ethernet based SNMP management interface, through the LAN to provide remote diagnostics and alarm conditions.
   d. Expandability—Unit shall provide for the connection if external battery packs in modules to extend the total unit run-time.
   e. Complete battery independence- Battery independent restart ensures automatic UPS power-up without user interaction after lengthy power outages, even when batteries are completely drained\discharged.
   f. Cord Length - 10'.
   g. Transfer Time- zero transfer time to battery.
   h. Battery Type- maintenance free sealed lead acid with electrolyte: leakproof.
   i. LED Status- On battery/Replace Battery/and overload indicators.
   j. Audible Alarms.
   k. Filtering -full time multi- pole noise filtering
   l. All UPS units shall be rack mountable with proper mounting hardware and support.
   m. UPS External battery Packs for 2200 or 3000 VA Tripp Lite for systems that specify extended run time such as the phone system.

3. UPS Sizes

   a. 1500 VA UPS (Tripp Lite part number SU1500RTXLCD2U) – Used in podiums, credenzas, conference rooms or classrooms
      1) Output Power Capacity- 1350W/ 1500VA.
      2) Nominal Output Voltage- 120V.
      3) Output Connections - (6) NEMA 5-15R
      4) Nominal Input Voltage- 120V.
      5) Input connections- NEMA 5-15P.

   b. 2200 VA UPS (Tripp Lite part number SU2200RTXLCD2U). Used in podiums, credenzas, conference rooms, classrooms and IDFs
      1) Output Power Capacity - 1800 wattts/2200VA.
      2) Nominal Output Voltage- 120V.
      3) Output Connections- (6) NEMA 5-15\20R and (1) NEMA L5-20R.
      4) Nominal Input Voltage- 120V.
      5) Input connections - NEMA 5-20P.
      6) Rack Mounted - 2U rack space.

7) Backup time- 12 minutes at half load (925 watts) 4 minutes at full load (1800 watts.)
8) Surge energy Rating – 570 joules.

c. 3000 VA UPS (Tripp Lite part number SU3000RTXLCD3U) Used in IDFs and MDFs
1) Output Power Capacity- 2700 wattts/3000VA.
2) Nominal Output Voltage- 120V.
3) Output Connections- (4) NEMA 5-15R and (4) NEMA 5-15\20R and (1) NEMA L5-30.
4) Nominal Input Voltage- 120V.
5) Input connections- NEMA L30P.
6) Rack Mounted - 2U rack space.
7) Backup time- 11 minutes at half load (1350 watts) 4 minutes at full load (2700 watts.)
8) LED Status- On battery/Replace Battery/and overload indicators.
9) Surge energy Rating - 570 joules.

d. 5000 VA UPS (Tripp Lite part number SU5000RT4U) – Used in MDFs
1) Output Power Capacity--3800 Watts/5000 VA
2) Max Configurable Power--3800 Watts/ 5000 VA
3) Nominal Output Voltage--120V, 208V
4) Power factor equals 75% or greater
5) Output Voltage Distortion--Less than 2%
6) Output Frequency--(sync to mains) 50/60 Hz +/- 3 Hz user adjustable +/- 0.1
7) Other Output Voltages--240
8) Crest Factor--3 : 1
9) Topology--Double Conversion Online
10) Waveform Type--Sine wave
11) Output Connections--(8) NEMA 5-15\20R, (2) NEMA L6-30R, (2) NEMA L6-20R
12) Bypass--Internal Bypass (Automatic and Manual)
13) Nominal Input Voltage--208V
14) Input Frequency--50/60 Hz +/- 5 Hz (auto sensing)
15) Input Connections--NEMA L14-30P
16) Input voltage range for main operation--100 - 140VAC (L1-N:L2-N)
17) Input voltage adjustable range for mains operation--85 - 136V
18) Other Input Voltages--240
19) Interface Port(s)--RJ-45 10/100 Base-T
20) Control panel LED status display with load and battery bar-graphs and On Line : On Battery : Replace Battery : Overload and Bypass Indicators
21) Alarm when on battery : distinctive low battery alarm : overload continuous tone alarm
22) Emergency Power Off (EPO)
23) Surge energy rating 365 Joules
24) Filtering Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449

B. PDU Standard of quality is Tripp Lite part number PDUMV20NET SWITCHED/IP FEATURE SET REQUIRED. Substituted material must be able to demonstrate product equivalency.

1. Raceway and all components shall be UL listed. The base and cover shall be ivory in color,

and shall be attached to the cable ladder of the rack system or wall field as per the drawings.

2. Electrical outlet strip shall have (13) NEMA 5-15\20 outlets.
3. Provide all attachment hardware required to securely attach the outlet strip to the back of the vertical cable ladder or wallfield. Refer to the detailed drawings for required locations.
4. All power strips shall be equipped with surge protection.
5. All power strips shall be come with adjustable mounting brackets for 2 or 4 post installation.
6. Strips shall be 20A-120V with NEMA 5·20P on a 15 foot line cord.
7. Install and test all outlets prior to project completion.
8. Provide outlet strip with attached cord and 3-prong plug.
9. All power strips will plug into UPS units unless otherwise specified.

2.13 COPPER CABLE PROTECTION UNITS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

B. Standard of quality of protection units is Circa.

C. The two most frequently used lightning protectors are listed below.

D. Circa Protector -- “Circa”, part number 1900A1-100, and Circa 3B3S-300 “Red” modules -100 for 100 pair.

E. Use Circa ,part number 1880ENA1/NSC-6 for single drops of 6-pair or less. Use Circa, part number 3B1E gas protector modules.

Part Number / Series	Description
1890BC1-25	25 Pair Protector
1890BC1-50	50 Pair Protector
1900A1-100K	100 Pair Protector
3B1E	Solid State Protector Module for 189B1
2626QC/QC	Protection Block (66 connection must add gas modules 3B1E (black) or 3B3E (red))
4B1E	Gas state Protector 5 Pin Black with Heat Coil
4B3S-75	Protector Module 5 Pin Red Solid state with Heat Coil
3B3S-300	Protector module 5 Pin Red Solid state w/o Heat coil
4B1S-300	Protector Module 5 Pin Black Solid state with Heat Coil
1880ENA1/NSC-6	6 Pair Protector

2.14 FIRESTOP

A. Standard of quality is EZ Path Fire rated cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
2. Be tested for the surrounding construction and cable types involved.
3. Have UL Systems permitting cable loads from; "Zero to 100% Visual Fill." This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
5. Be "Zero-Maintenance", zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
    a. Opening or closing of doors.
    b. Spinning rings to open or close fabric liner.
    c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
    d. Furnish letter from manufacturer certifying compliance with this definition of "Zero-Maintenance".
6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
8. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
9. Cable pathway shall replace conduit sleeves in walls and floors, and;
10. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.
11. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.
12. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.
13. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.

14. When multiple units are ganged in walls, devices shall be anchored by means of a tested grid.
15. Cable tray shall terminate at each barrier (wall) and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier (wall). Cable tray shall NOT pass through the barrier (wall).
16. Substituted material must demonstrate product equivalency.

B. As an alternate to using a fire-rated or non-rated cable pathway device for single low voltage cables (up to 0.27 in. (7 mm) O.D) penetrating one or two-hour, gypsum board/stud wall assemblies or non-rated assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated EZ Path individual cable grommet may be substituted. The product shall consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable. The grommet product shall be capable of locking into place to secure the cable penetration within the wall assembly. The grommet shall be UL Classified and tested to the requirements of ASTM E814 (UL1479) and CAN/ULC S115.

17. Acceptable Products from STI:

Part Number / Series	Description
EZD22	2” EZ Path Firestop Device
EZD33FWS	3” EZ Path Firestop Device
EZDP133CWK	3” EZ Path Firestop Device Kit (for 4” conduit)
EZDP33FWS	3” EZ Path Firestop Device Kit (square mount)
EZP433W	3” Ganging Accessory (Qty 4) for 3” EZ Paths
EZD44S	6” EZ Path Firestop Device
EZDP44S	6” EZ Path Firestop Device Kit (square or round mount)
EZP544W	Ganging Accessory (Qty1-5) for 6” EZ Paths
EZGxxxxx	Grid for riser applications
RFG2	Individual Cable EZ firestop grommet (10 pack)

2.15 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building’s electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a PBB (Primary Bonding Busbar) formerly known as the telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a SBB (Secondary Bonding Busbar formerly known as the telecommunications ground bus bar (TGB). The PBB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective SBB or PBB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

E. Standard of quality for all grounding and bonding products shall be Legrand.

F. Acceptable substitutions are Erico and Panduit

PART 3 - EXECUTION

3.1 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where Caddy box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA 568.1-D document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. Bend radius of the twisted-pair horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA 569-D maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA 606-C. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

3.3 HORIZONTAL CROSS CONNECT INSTALLATION

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA 568-D standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained as close as possible to the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.4 OPTICAL FIBER TERMINATION HARDWARE

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray

F. All spare strands shall be installed into spare splice trays.

3.5 BACKBONE CABLE INSTALLATION

A. Backbone cables shall be installed separately from horizontal distribution cables

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.6 COPPER TERMINATION HARDWARE

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-D standard, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.7 RACKS

A. Racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.

B. Racks shall be placed with a minimum of 36 inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.11 of this document.

D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.8 FIRESTOP SYSTEM

A. All firestop systems shall be installed in accordance with the manufacturer recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.9 GROUNDING SYSTEM

A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA 607-C standard, and shall be installed in accordance with best industry practice.

B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.10 IDENTIFICATION AND LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA-606-C.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

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 ANSI/TIA-606-C. 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 of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. 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.

3. 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.

4. Both ends of all backbone cable shall be labeled. Labels will be self laminating and machine generated. The label shall contain the following information:
    a. The Origination (TR it is feeding from).
    b. The Destination (TR it is feeding).
    c. Number of pairs or fibers

5. Both ends of all horizontal cables shall be labeled. Labels shall be self-laminating and machine generated. The cable, workstation faceplate, panel ports and block positions shall be labeled with the room number, location in room, outlet type & # (data D1, D2, etc). In rooms with multiple outlets, label clockwise as you enter the room: 1, 2, 3 e.g. a data port at the first drop location to the left of Room 216 door would be (216-1 D1). When terminating workstation cables in the TR, organize and label the cables in numeric room number order at the patch panel.

6. CNS will approve all labeling schematics prior to installation. "As-Built" drawing with all outlets identified shall be provided.

F. Labels shall be self-laminating or computer-printed type with printing area and font color that contrasts with cable jacket color. Handwritten labels will not be acceptable.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

2. All labeling methodology, identification logic, and materials will be approved by customer prior to installation.

3. If existing labeling scheme is in place, all labeling will defer to currant scheme as to stay consistent with facility.

3.11 TESTING AND ACCEPTANCE

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA 568D; marginal passes (*PASS) are not acceptable. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the Legrand Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.

2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance.

3. The basic tests required are:

    a. Wire Map
    b. Length
    c. Attenuation
    d. NEXT (Near end crosstalk)
    e. Return Loss
    f. ELFEXT Loss
    g. Propagation Delay
    h. Delay skew
    i. PSNEXT (Power sum near-end crosstalk loss)
    j. PSELFEXT (Power sum equal level far-end crosstalk loss)

4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA 568-D Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

6. Category 6A Performance

    Shall meet the channel requirements outlined below for a 100-meter, 4-connector channel.

    Channel Margin Guarantees

Parameter	Margin vs. TIA-568-C.2
Insertion Loss	3%

NEXT	5 dB
PSNEXT	5 dB
Return Loss	3 dB
ACRF	5 dB
PSACRF	5 dB
ACR	5 dB
PSACR	5 dB

C. Fiber Testing

1. Testing procedures shall be in accordance with the following:
    a. ANSI/TIA 568-D
    b. ANSI/TIA 568.1-D
    c. ANSI/TIA 526-7-A, Method A.1
    d. ANSI/TIA 526-14-C, Method B
    e. TSB-140 Tier 1 fiber testing is required. Tier 2 Fiber Testing is recommended
    f. ANSI-TIA-1152-A determines the copper field test instrument values.
2. Preparation
    a. Properly clean all connectors, adapters, and jumpers prior to testing.
    b. Insure that the testing jumpers are of the same fiber core diameter and connector type as the fibers to be tested.
    c. The power meter shall be properly calibrated prior to testing. Contractor to provide written confirmation of the calibration, with the power meter serial number, to the Owner, if requested. If this documentation is not available upon request, the Contractor shall re-test all optical fiber cables after documented calibration of the power meter is accomplished.
3. Test Equipment
    a. Optical power meter and source (Certification tester Fluke or Agilent preferred). Suitable OTDR with launch cable for Tier 2 testing. OTDR Launch Cable length recommendation is 75 meters for MMF and 300 meters for SMF systems.
4. Testing
    a. All Multimode fibers shall be tested to the requirements of ANSI/ TIA-568-D, TIA-525-14A (Method A.1) and TSB-140. Optical fibers shall be tested at both 850 nm and 1300 nm wavelengths for end-to-end insertion loss .and Bi –Directional (MTR to TR-1, TR-1 to MTR)
    b. All Single-mode fibers shall be tested to the requirements of ANSI/ TIA-568-D, TIA-526-7 (or Method A.1) and TSB-140. Optical fibers shall be tested at both 1310 nm and 1550 nm wavelengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR)
    c. Insure that the power meter and light source are set to the same wavelength prior to testing each fiber.
    d. Connect an appropriate test jumper to the light source and power meter.
    e. Power on both the power source and light meter, allowing them to stabilize.
    f. Record the reference power reading in dB. If the jumper is removed from the light source for any reason, the reference power reading must be re-established.
    g. Insert a second appropriate jumper, using an appropriate adapter, between the first jumper and the power meter. Record the power reading in dB.

h. Reference TSB-140 for additional recommendations and testing guidelines.
i. Provide written documentation of all test results to owner. Provide electronic copy of test results, in original tester format, to manufacturer when registering project for warranty on-line.

3.12 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.13 TEST RESULTS

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA 568-C including applicable TSB’s and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (format to be determined by the end user).

D. Test documentation shall also be provided to the manufacturer within three weeks after the completion of the project. Test results shall be uploaded when registering the project for warranty using the manufacturer's on-line system. Test results shall be in the tester's original format from an approved tester listed on manufacturer's website. All test results must show a PASS; marginal passes (*PASS) are not accepted.

E. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.14 AS-BUILT DRAWINGS

A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD rel. 14) form.

PART 4 - WARRANTY AND SERVICES

4.1 WARRANTY

A. A warranty shall be provided for all internal infrastructure wiring as it pertains to voice and data networking for both copper and fiber systems. All installations must be performed according to the manufacturer's System Warranty and Performance Application.

B. The warranty will combine an extended product and applications assurance warranty for a minimum of 25 years.

C. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.

D. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA-568.1-D. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.

E. The contractor shall provide a warranty on the physical installation.

4.2 CONTINUING MAINTENANCE

A. The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall be performed by a certified Contractor and shall be added to the warranty when registered with manufacturer.

4.3 FINAL ACCEPTANCE & SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a certificate, from the manufacturer, registering the installation.

SECTION 283100 - FIRE ALARM SYSTEM

1. GENERAL

A. SCOPE AND RELATED DOCUMENTS

(1) The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.

(2) The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

(3) The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.

(4) The work included in this section shall be coordinated with related work specified elsewhere in these specifications.

(5) CONNECT TO EXISTING SIEMENS BUILDING FIRE ALARM SYSTEM.

B. QUALITY ASSURANCE

(1) Every component, device, transmitter, software, etc., that are included in the work, to make up a complete Fire Alarm System shall be listed as a product by the manufacturer under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

(2) The system power, signal and controls wiring shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

C. GENERAL

(1) Furnish and install a complete digital multiplex Fire Alarm System as described herein and as shown on the plans; to be wired, connected, completely tested, and left in first class operating condition. The system shall use individually-addressable digital multiplex device circuit(s) with individual device supervision, appliance circuit supervision, incoming normal and stand-by power supervision. In general, systems shall include a control panel, manual pull stations, automatic fire detectors, horns, flashing lights, annunciator (if indicated), raceways, all wiring, connections to devices, connections to valve tamper switches, water flow switches and mechanical controls, outlet boxes, junction boxes, and all other necessary materials for a

complete, operating system. Reconnect to existing system device locations accordingly. Provide new devices accordingly if tie-in to existing manufacturer/system is not possible.

The fire alarm control panel shall allow for loading or editing of any special instructions or operating sequences as required. No special tools, modems, or an off-board programmer shall be required to program the system to facilitate future system expansion, building parameter changes, or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory.

(2) All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. Any catalog numbers specified under this section are intended only to identify the type, quality of design, materials, and operating features desired.

The listing of specific catalog numbers and equipment parameters is not intended to limit competition among other manufacturers that propose to supply equivalent equipment and services. Fire alarm systems as manufactured by Siemens/Cerberus to match existing,

(3) Equipment submissions for shop drawing review must include a minimum of the following:

a. Complete descriptive data indicating UL listing for all system components.

b. Complete sequence of operations of the system.

c. Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.

d. A copy of any state or local Fire Alarm System equipment approvals.

e. An Autocad (latest version) produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as zoning boundaries and schedule of zone legends as intended to appear on annunciators. Provide three CD-Rom copies of as-built drawings and all system operational software at close of project, to be included in operation and maintenance manuals.

(4) No work shall be done until the drawings are approved by the local Authority Having Jurisdiction.

D. OPERATION

(1) The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

a. 1) The appropriate initiating device circuit indicator (red color) shall flash on the control panel until the alarm has been silenced at the control panel. Once silenced, this same

indicator shall latch on. A subsequent alarm received after silencing shall flash the subsequent zone alarm indicator on the control panel and resound alarms and flashing signals. These same conditions shall occur at any remote annunciator.

2) A pulsing alarm tone shall occur within the control panel until silenced.

b. All alarm indicating appliances shall sound in a temporal code pattern until silenced by an alarm silence switch at the control panel (or the remote annunciator, if any).

c. All doors normally held open by door control devices shall close. Doors shall also be released in the event of incoming normal power failure.

d. A supervised signal to notify the local fire department or an approved central station (as required by local codes) shall be activated.

e. A supervised signal shall directly activate, shut down or reconfigure the air handling systems as required by NFPA or as otherwise indicated herein. Provide necessary interlock wiring as required to control mechanical equipment..

f. The Contractor(s) shall coordinate with each other as necessary to provide all required auxiliary contacts, DDC systems interfaces, equipment, etc., as needed to shut down or otherwise control air handling systems per NFPA and all applicable codes.

g. The system shall be wired with two circuits to all Notification devices so that when an alarm is acknowledged, silencing the audibles, the visual units shall continue in operation until the main control panel has been reset. If local codes require other than this arrangement, the system shall be wired in accordance with the code that is applicable.

(2) The alarm indicating appliances shall be capable of being silenced only by authorized personnel operating the alarm silence switch at the main control panel or by use of a similar key operated switch at the remote annunciator (where remote units are provided). A subsequent alarm shall reactivate the signals. Operation of the alarm silence switch shall be indicated by trouble light and audible signal.

(3) The alarm activation of any elevator lobby shaft, pit or equipment room smoke detector shall, in addition to the operations listed above, cause the elevator cabs to be recalled according to the following sequence:

a. If the alarmed detector is in any location or on any floor other than the main level of egress, the elevator cars shall be recalled to the main level of egress.

b. If the alarmed detector is on the main egress level elevator lobby, the elevator cabs shall be recalled to the pre-determined alternate recall level.

c. Provide auxiliary contacts within the base of each elevator lobby smoke detector, with each separate landing to be wired back separately to the elevator controller. Coordinate all

equipment terminations and sequence of operation with the elevator installer. The use of digital to analog controllers to accomplish this function will be acceptable, if in compliance with codes.

d. Provide heat detectors within 12" of each sprinkler head where they are installed in elevator equipment rooms, shafts or pits, in accordance with code. The temperature rating and wiring of the detectors shall be coordinated with the sprinklers, per ANSI Elevator Code and NFPA. Wire to interrupt elevator power per the applicable code.

(4) The activation of any standpipe water valve tamper switch or sprinkler zone valve tamper switch shall activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper Switch" indicator at the system controls (and the remote annunciator[s]). There shall be a distinction in the audible trouble signals between valve tamper switch activation and opens or grounds on fire alarm circuit wiring.

a. Activating the trouble silence switch will silence the supervisory audible signal while maintaining the "Sprinkler Supervisory Tamper" indicator showing the tamper contact is still activated.

b. Restoring the valve to the normal position shall cause the audible signal and visual indicator to pulse at a fixed rate.

c. Activating the trouble silence switch shall silence the supervisory audible signal and restore the system to normal.

(5) Include with the control panel, as an auxiliary function, a built-in test mode that, when activated, will cause the following operation sequence:

a. The city connection circuit shall be disconnected.

b. Control relay functions shall be bypassed.

c. The control panel shall show a trouble condition.

d. The panel shall automatically reset itself.
e. Any momentary opening of an initiating or indicating appliance circuit shall cause the audible signals to sound for a minimum of two seconds to indicate the trouble condition.

(6) A manual evacuation switch shall be provided to operate the system indicating appliances and/or initiate "Drill" procedures.

(7) Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system and initiate a trouble condition at the control panel.

(8) Include any and all detection equipment and interface relays as required to provide a 100% code approved and supervised pre-action Fire Suppression system. Coordinate with the Fire Protection installer as required.

E. SUPERVISION

(1) The system shall contain Class "B" (Style "B") independently supervised initiation circuits as required for the zoning indicated. Circuits shall be arranged so that a fault in any one zone shall not affect any other zone. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

(2) There shall be supervisory initiation circuit(s), as required, for connection of all sprinkler valve tamper switches. Wiring methods which require any fire alarm initiation circuits to perform this function shall be deemed unacceptable; i.e., sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). These independent initiation circuit(s) shall be each labeled "Sprinkler Supervisory Tamper Switch" and shall differentiate between tamper switch activation and wiring faults. Provide individual annunciation for the main post indicator valve and each tamper switch as indicated by the zoning schedule on the plans or as otherwise required by codes. For these circuits and all exterior underground copper circuit wiring, provide proper surge suppression and protection for circuit.

(3) There shall be independently supervised and independently fused indicating appliance circuits as required for alarm audible signals and flashing alarm lamps.

(4) All auxiliary manual controls shall be supervised so that all switches must be returned to the normal (automatic) position to clear system trouble.

(5) Each independently supervised circuit shall include a discrete (amber color) "Trouble" indicator to indicate disarrangement conditions, per each circuit.

(6) The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel and the annunciator. A green color "power on" indicator shall be displayed continuously while incoming power is present.

(7) The system batteries shall be lead-acid type, supervised so that disconnection or failure of a battery shall be audibly and visually indicated at the control panel (and the annunciator).

(8) Wiring to a remote annunciator (if provided for system) shall be supervised for open and ground conditions. An independent annunciator trouble indicator shall be activated and an audible trouble signal shall sound at the control panel.

F. POWER REQUIREMENTS

(1) The control panel shall receive 120 VAC power via a dedicated circuit. The incoming circuit shall have suitable overcurrent protection within the control panel, as well as at the circuit source. If additional circuits are required for this or other control units, they shall be provided by the Contractor.

(2) If the facility is equipped with an emergency standby power generator, the fire alarm equipment shall be connected to this system, per N.E.C.

(3) The system control panel and auxiliary equipment, such as power supplies shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of time as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes.

(4) All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

(5) Power supplies for Notification signals, whether in the main panel or within remote power supply cabinets, shall be designed to provide a minimum of 20% spare capacity for future signals.

G. FIRE ALARM CONTROL PANEL

(1) Connect to existing Fire Alarm Control Panel

H. SYSTEM SOFTWARE AND PROGRAMMING

(1) Provide all programming and software necessary to place annunciators and controls in full operation. System set-up shall allow for changes in annunciator legends without rewiring or addition of programming or electronics. Furnish initial programming and reprogramming as needed to accommodate changes in the system up to the time of system acceptance by the engineer without extra charge.

I. REMOTE ANNUNCIATOR

(1) Where indicated on the plans, provide and install annunciator/control panel. The panel shall be of vandal-resistant construction and shall contain a liquid crystal illuminated display for alphanumeric indication of all required functions. The panel shall also contain the following control functions, activated by a master system enable key switch on front panel:]

a. Remote system reset switch, to complement main control panel reset switch.

b. Remote alarm signal silence switch.

c. Remote manual evacuation switch, to initiate fire drill functions, same as at main control panel.

d. Remote trouble silence switch to silence trouble alarms in annunciator panel and main control panel.

e. Install panel on properly sized outlet box, 54" AFF to centerline. Panel shall contain tamper-resistant LED test switch in panel, local audible alarm, system power on, trouble LED indicators and master system enable key switch, keyed alike with the main control panel.

(2) Annunciator legends shall be custom, to display both zone number and brief legend indicating the area or device associated with that zone. The legends shall be electronically generated on an alphanumeric display panel. The fire alarm system vendor shall coordinate the legends with the Engineer at shop drawing review.

(3) Wiring between main control panel and annunciator(s) shall be fully supervised, and accomplished over twisted shielded pair and/or THWN wiring as required by the manufacturer, per N.E.C. and NFPA.

J. PERIPHERAL DEVICES

Note: On fully digital multiplex systems, provide addressable devices, bases or modules for devices listed herein. Each device shall be an individual address on the system. Addressable bases or modules shall be U.L. listed for the device served.

(1) MANUAL PULL STATION

a. Manual stations shall be double action and shall be constructed of high impact, red lexan or cast metal with raised white lettering and a smooth high gloss finish. The manual pull station shall have a hinged front with key lock. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock open in a protruding manner. Furnish one key for each manual station to owner at close of project, during instruction period. Install within 60" of each exit, per code, whether indicated on the drawings or not.

(2) CEILING-MOUNTED SMOKE DETECTORS, PHOTOELECTRIC TYPE

a. Furnish and install where indicated on the plans or required, ceiling-mounted smoke detectors. Provide separate outlet-box mounted base with auxiliary relay, or standard base, as required.

b. Smoke Detectors shall be listed to U.L. Standard 268 and shall be compatible with their control equipment. Detectors shall be listed for this purpose by Underwriters' Laboratories,

Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. Loss of the operating voltage shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Detectors shall be capable of being reset at the main control panel.

c. No radioactive materials shall be used. Detector construction shall provide mounting base with twist-lock detector head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-cleaning contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide full solid state construction, and compatibility with other normally open fire alarm detection loop devices such as heat detectors, pull stations, etc.

d. To minimize nuisance alarms, voltage and RF transient problems, suppression techniques shall be employed as well as a smoke verification circuit and an insect screen. The detector head shall be easily disassembled to facilitate cleaning.

e. Remote LED alarm indicators shall be installed where required.

f. Smoke detectors (and all other system electronics) shall be shielded to protect circuitry from EMI problems generated by power fields, cellular phones, etc.

g. Special Note: The Contractor installing smoke detectors shall use care in the final positioning of all devices. They shall not be installed closer than 36" from an air diffuser or return grille, closer than 24" from a ceiling/wall intersection, or similar location that would diminish detector performance. Refer to and comply with NFPA 72E, "Standard On Automatic Fire Detectors".

h. Provide smoke detector at each fire alarm system control component, as required by code.

(3) AUTOMATIC HEAT DETECTORS (RATE-OF-RISE TYPE)

a. Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. When the fixed-temperature portion is activated, the units shall be non-restorable and give visual evidence of such operation. Heat detectors shall be 135, 165 or 195ℕF, as indicated on plan. Where not indicated, provide 165º F units. Provide as indicated or required.

(4) AUTOMATIC HEAT DETECTORS (FIXED TEMPERATURE TYPE)

a. Where indicated on the plans, provide automatic heat detectors of the non-restorable type, of the temperature rating as indicated or required. Detector heads shall be mounted to an outlet-box mounted base. Provide auxiliary contacts as needed. Provide as indicated or required.

(5) AUDIBLE AND VISUAL UNITS

a. Audible signals shall be polarized and shall be operated by 24 VDC. Each audible assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors will not be accepted. The audible visual units shall be equipped with a xenon-type strobe which shall be semi-flush mounted on 4" square outlet box. Each audible device shall produce a minimum sound pressure level of 92db at 36" on axis. Provide units as manufactured by Wheelock, Inc., or approved equivalent. Locate as indicated or required. All audible tones for same function shall be identical, per NFPA. Provide sufficient audible units to comply with code for required coverage. Provide temporal coded signals.

b. The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements.

c. Audible units and visual units shall be wired to separate Notification circuits, allowing for silencing of audibles with alarm acknowledgment, continuing operation of strobes until system reset. Addressable devices may be used to fulfill this requirement.

d. Provide system-wide synchronization of all visual devices, so that all strobes flash at the same rate and at the same time, complying with A.D.A.

(6) VISUAL UNITS

a. Stand-alone visual indicating units shall be xenon type strobe matching audio-visual units. These devices shall be UL listed and be or wall mounted. A high-impact clear lens shall project out from backplate. Lettering, if any, shall be oriented upright to the standing viewer. Candela output values of all visual units shall be selected for the covered spaces geometry and size, complying with A.D.A. and NFPA.

(7) DOOR HOLDERS

a. Magnetic door holders shall be 24 volt A.C., and shall have an approximate holding force of 25 lbs or greater, if required to restrain door. The door-mounted portion shall have a plated steel pivot mounted armature with shock absorbing bearing. Unit shall be capable of being either surface, flush, semi-flush or floor mounted as required. Door holders shall be UL listed for their intended purpose. Where door mounted, locate armature 6" down from top and 6" in from strike side of leaf. Where door swing prevents direct contact between armature and holder pole piece, provide non-removable plated chain to close gap as tightly as possible. Verify holder positioning with Architect prior to mounting any devices. Unless otherwise indicated, provide semi-flush mounted holders 6" below top of door leaf as noted above, with blocking in wall to support force of door impact against holder and outlet box. Provide at all needed locations as indicated or required. Coordinate with architectural hardware schedule, as applicable to project.

(8) DUCT SMOKE DETECTORS

a. Duct smoke detectors shall be of the solid state photoelectric type, operating on the light scattering photodiode principle. The detectors shall ignore invisible airborne particles or smoke densities that are below the set alarm point. No radioactive materials shall be used. The basic construction of duct smoke detectors shall be the same as that previously described for ceiling-mounted smoke detectors. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm status LED visible through a transparent cover, panel or in housing.

b. The Contractor shall furnish air duct smoke detectors with template to the sheetmetal or air handling unit installer for installation. Coordinate length of sampling probe required and furnish appropriate length. Probe tube shall be located in accord with manufacturer's recommendations, to give maximum sampling rate of airflow. Provide multiple detectors, as required, if a single device will not provide adequate sensing due to duct size or air velocity. Wire multiple detectors on a single air handling system as a single zone or address unless otherwise required by prevailing codes. Field verify quantity of detectors needed to provide NFPA-compliant coverage of the air handling unit and provide as required.

c. Detector supervised power and alarm wiring (from F.A. control panel) is to be provided by the Contractor. Interlock wiring from auxiliary contacts to stop or otherwise control air handling unit fan motor(s) is to be provided by the Contractor. Provide auxiliary contacts as required. Zone wiring and indication for air duct smoke detectors shall be maintained separate from area detection devices. Detector shall be capable of being reset at the main control panel, and at a local test/reset station.

d. Where air duct smoke detectors are located in other than Mechanical Rooms or in spaces not easily visible, a remote alarm/power indicating LED key reset station shall be installed. These remotes shall be ganged together, if required, and labeled accurately as to which unit is reporting an alarm condition.

e. Where air duct smoke detectors are indicated to be furnished at concealed air handling units above ceilings or smoke damper locations, furnish as outlined above. Also provide remote indicating alarm LED flush in corridor wall at 7'-0" A.F.F. immediately below installation, or as close as practical to installation. The Contractor is to provide control wiring, E.P. switches, etc., as required to operate smoke dampers, as well as the required operating circuit. Coordinate all requirements with the installer of smoke dampers.

f. Ionization - type detectors shall not be utilized for air duct smoke detection.

g. All air duct smoke detector installations and materials shall be in accord with U.L., NFPA, and any other applicable codes.

(9) WEATHERPROOF DEVICES AND EXPLOSION-PROOF DEVICES

a. Where the anticipated atmosphere or installation conditions require weather-proof, explosion-proof or other specially housed devices, they shall be U.L.-listed and NFPA-compliant and provided as indicated or required. Verify installation conditions and indicate type of device on shop drawing submission.

(10) END OF LINE RESISTOR

a. End-of-line devices (if required) shall be flush-mounted, located at 7'-0" A.F.F. in corridor walls or as indicated.

(11) GUARDS FOR DEVICES

a. Where detectors, manual stations, signals, etc., require or are indicated to be furnished with a guard, utilize a U.L. listed unit, compactly covering and compatible with the device. Provide as indicated or required. Guards shall not diminish the performance of any device.

(12) DIGITAL ALARM COMMUNICATOR/TRANSMITTER

a. Provide a U.L.-listed and NFPA-compliant digital alarm communicator/transmitter (D.A.C.T.). Install at telephone terminal board or telephone service entrance and provide supervised wiring to fire alarm control panel as required. This unit may be semi-flush mounted at the F.A.C.P. location with prior approval by the Engineer. It may also be integrated within the main control panel, if U.L.-listed for the purpose.

b. The installation and connection of the D.A.C.T. shall be in compliance with all provisions of N.F.P.A. 71 and all other applicable codes. The installation and connection shall be acceptable to the Authority Having Jurisdiction, as well as the telephone company (or companies) over whose lines the signal(s) will be transmitted. Include any costs associated with telephone company work and services required in bid. Telephone connection shall be in compliance with NFPA 71, chapter five.

c. The D.A.C.T. shall be capable of transmitting all information relative to system status changes due to alarm, trouble, water flow, and any other information as required by current codes applicable to the facility. This information shall be transmitted to a U.L. listed Central Receiving Station, that also is maintained in accord with the requirements of NFPA 71. Connect system to transmit signals as required by local codes.

d. As a part of this contract, the services of a Central Receiving Station shall be engaged for a period of one year from the date of substantial completion, this date as defined elsewhere in these documents. The Central Receiving Station facility selected shall be in full compliance with NFPA and other applicable requirements. The Contractor shall initiate this service, provided on a contract basis, and shall include any costs associated with this provision in his bid. The actual beginning date of the contract with the central receiving station may be adjusted at the discretion of the Engineer, but in no case shall be for less than one year. The contractor shall notify the owner in writing by certified mail that this

service has been contracted for and explain the provisions of this service adequately. A copy of this communication and the return receipt shall be forwarded to the Architect and the Engineer.

(13) REMOTE POWER SUPPLY UNITS FOR PERIPHERAL

a. Provide remote power supply(ies) as required for proper system operation.

b. Remote power supplies shall be provided with local intelligence compatible with the digital multiplex network, so they have a unique address, providing the ability to monitor the supply for loss of power, shorts, grounds and other supervisory functions.

c. Where required by the fire alarm system manufacturer, remote power supplies shall be provided that will provide sufficient current to drive audio/visual or other required devices.

d. These units shall be located in electrical closets, mechanical rooms or similar spaces. They shall not be installed in finished areas, storage rooms, etc., without the permission of the Engineer. All locations shall be indicated on the shop drawing submissions.

e. Provide dedicated 120 volt power circuit(s) from nearby panelboards as required, whether indicated on the plans or not.

K. INSTALLATION

(1) Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be in a completely separate conduit system from power wiring or other raceway systems. Minimum conduit size shall be 3/4" trade size. Maximum wire fill shall be 40%, for any raceway system. Provide **RED** conduit for fire alarm system in exposes ceiling areas. All concealed areas above ceiling and in gypsum walls, **RED** MC cable can be utilized

All junction boxes shall have coverplates painted red and labeled "Fire Alarm". A consistent wiring color code shall be maintained throughout the installation. The number of wiring splices shall be minimized throughout. Excessive wire splicing (as determined by the Engineer), shall be cause for rejection of the work.

(2) Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate tradesmen or other contractors.

(3) The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of installation.

(4) The manufacturer's authorized representative shall provide on-site supervision of installation, and shall perform the initial "power-up" of the system after he has thoroughly checked the installation.

(5) Operation and maintenance manuals submitted for this project shall list names, license numbers, and telephone numbers of at least two installers that are employed full time by the supplier/manufacturer to install and test fire alarm systems in the installation location.

A floor plan drawing indicating fire alarm devices and wiring only, shall be provided by the manufacturing company for job site use. These drawings shall be approved by the State Fire Marshal's Office or Local Authority Having Jurisdiction, as appropriate and in accord with code requirements. A copy of this drawing shall be submitted to the Engineer for his review, approval and project records.

L. TESTING

(1) The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's representative and the Local Fire Marshal. Upon completion of a successful test, the Contractor shall certify the test results in writing to the Fire Marshal, Owner, General Contractor, Architect and Engineer. Provide one week's written advance notice of the test to all concerned parties.

(2) All auxiliary devices the fire alarm system is connected to, including tamper switches, flow switches, elevator controls, remote receiving stations, etc., shall be fully tested for proper operation where interfacing with the fire alarm system.

(3) The Contractor shall provide a minimum of three hours of instructional time to the Owner in the operation and maintenance of all equipment and components. A receipt shall be obtained from the Owner that this has been accomplished, and a copy forwarded to the Engineer. Provide additional training time if required by the Owner at no charge to the contract or as direct charge to the Owner.

M. WARRANTY

(1) The Contractor shall unconditionally guarantee (except for vandalism or misuse) the completed fire alarm system wiring and equipment to be free from inherent mechanical, software and electrical defects for a period of one year from the date of substantial completion.
(2) The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION 283100

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. DIP: Ductile Iron

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. In accordance with Town of Amherst - Manual of Specifications and Standard Details, current edition.

2.2 GATE VALVES

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

2.3 WATER METERS AND WATER METER BOXES

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Provide Product indicated on Drawings or approved equal.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: As indicated on Drawings.

B. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.

a. Standard: ASSE 1060.
b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

1) Housing: Reinforced aluminum or fiberglass construction.

a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
b) Drain opening for units with drain connection.
c) Access doors with locking devices.
d) Insulation inside housing.

e) Anchoring devices for attaching housing to concrete base.

2) Electric heating cable or heater with self-limiting temperature control.

B. Enclosure Bases:

1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.6 FIRE HYDRANTS

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.3 ANCHORAGE INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.4 VALVE INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.5 WATER METER AND WATER METER BOX INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.6 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.7 CONCRETE VAULT INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.8 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.9 FIRE HYDRANT INSTALLATION

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

3.11 CONNECTIONS

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

3.12 FIELD QUALITY CONTROL

A. In accordance with the City of Staunton - Manual of Specifications and Standard Details, current edition.

B. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 311000 - 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.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities.
8. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify Miss Utility and Owner for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition".

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated in Geotechnical Report in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

3.8 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, pavements, turf and grasses, and plants.
2. Excavating and backfilling for structures.
3. Drainage course for concrete slabs-on-grade.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. Section 013200 "Construction Progress Documentation" for recording preexcavation and earth moving progress.
2. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer.

C. Utility Locator Service: Notify "Miss Utility" for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

I. Sand: ASTM C 33; fine aggregate.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi (550 kPa), when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495.

2.4 GEOFOAM

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength.

B. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength.

1. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.

C. Rigid Cellular Polystyrene Geofoam: ASTM D 6817, Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation.

D. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors.

2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.

4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches (600 mm) outside of concrete forms other than at footings.
    b. 12 inches (300 mm) outside of concrete forms at footings.
    c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
    f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

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 projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, 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 or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete".

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete".

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 GEOFOAM FILL

A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

1. Place leveling course on subgrades free of mud, frost, snow, or ice.

B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.

C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.

D. Cover geofoam with subdrainage geotextile before placing overlying soil materials.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) 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 soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, sidewalks and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).

2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.16 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 1000 feet (305 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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 construction dewatering.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
3. Review geotechnical report.
4. Review proposed site clearing and excavations.
5. Review existing utilities and subsurface conditions.
6. Review observation and monitoring of dewatering system.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.7 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. The geotechnical report is referenced elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and

to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. 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.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

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 dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system 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 authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

3.2 INSTALLATION

A. 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.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 312333 - EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES

PART 1-GENERAL

1.1 DESCRIPTION

A. Work Included: Excavation and preparation of trenches as shown on the plans and specified herein, backfilling and site restoration.

B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:

1. Section 329200 – Turf and Grasses

1.2 REFERENCES

A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.

B. American Society for Testing and Materials Publications (ASTM) :

1. D 448-Standard Classification for Sizes of Aggregate for Road and Bridge Construction
2. D 698-Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft)
3. D 1556-Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
4. D 2167-Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
5. D 2487-Standard Classification of Soils for Engineering Purposes (unified Soil Classification System)

C. Virginia Department of Labor and Industry - Occupational Safety and Health Standards for the Construction Industry

1. Subpart P-Excavations, Trenching, and Shoring

1.3 DEFINITIONS

A. Controlled Fill: Controlled fill is required beneath all areas on which final grade is not placed on original excavated soil.

B. Classified Excavation: For the purposes of payment, material shall not be classified.

C. Satisfactory Materials: Materials classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL are satisfactory as fill for overlot grading and are satisfactory in-situ.

D. Unsatisfactory Materials: Materials classified by ASTM D 2487 as OL, OH, MH, CH, and PT are unsatisfactory in-situ and as fill. Unsatisfactory materials also include those materials containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 6 inches. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

E. Cohesionless and Cohesive Materials: Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have plasticity index of zero.

F. Degree of Compaction: Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 698, abbreviated below as a percent of laboratory maximum density.

G. Topsoil: Material obtained from excavations, suitable for topsoils, is defined as the upper 6 inches of existing soil cover. Topsoil shall consist of friable clay loam, free from roots, stones, and other undesirable material and shall be capable of supporting a good growth of grass.

H. Rock: Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume. Pavements will not be considered as rock.

I. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 18 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

J. Unstable Material: Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

K. Select Granular Material: Select granular material shall consist of well-graded sand, gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall not contain more than 10 percent by weight of material passing a No. 200 mesh sieve. The maximum allowable aggregate size shall be 1 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

L. Initial Backfill Material: Initial backfill material shall consist of select granular material or satisfactory materials free from rocks 1 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

1.4 QUALITY ASSURANCE

A. Testing Results: Copies of all laboratory and field test reports shall be submitted to the OWNER and ENGINEER within 72 hours of the completion of the test.

PART 2-PRODUCTS (NOT USED)

PART 2 - EXECUTION

3.1 GENERAL

A. Classification: Excavation and material shall be unclassified for purposes of payment. No extra payment will be considered for any excavation regardless of the type of material encountered including rock.

3.2 CLEARING

A. General: Only that portion of the work area actually needed for construction shall be cleared or used by heavy equipment unless directed otherwise by the OWNER. In no case shall clearing or debris from clearing operations be taken past right-of-way lines or permanent easement lines onto private property. Areas disturbed by construction operations shall be protected from erosion by suitable methods outlined in the Virginia Erosion and Sediment Control Handbook. Equipment and materials shall be stored only in approved areas.

3.3 EXCAVATION AND PREPARATION OF TRENCH

A. General: Depth of trenches shall provide a minimum of 36” cover, measured from the top of pipe, unless otherwise noted on the plans and cut sheets.

B. Trench: The trench shall be excavated to allow for a depth of ¼ of the pipes outside diameter or a minimum of 6 inches below pipe of ASTM D 448 #57 or #68 aggregate bedding in earth and 6 inches of aggregate bedding in rock.

C. Width: Width shall be sufficient to allow pipe installation without walking or standing on pipe. The trench width at a point 12 inches above the top of the pipe shall not be less that 6 inches not more than 12 inches on each side of the pipe’s largest diameter unless otherwise directed by the Engineer.

D. Unsuitable Material: Wet or otherwise unsuitable soil at the subgrade shall be removed and replaced with approved sound materials at no cost to the OWNER. Excess or unsuitable materials shall be disposed of by the CONTRACTOR.

E. Rock Excavation: Ledge rock, boulders, and large stones shall be removed to provide a clearance of at lease 6-inches below and on each side of all pipe, manholes, valves or other appurtenances and overdepth shall be backfilled with 6-inches of ASTM D 448 #10 (PVC) or #26 (Ductile Iron) aggregate bedding.

F. Topsoil: Topsoil shall be stripped from excavation area and stockpiled separately from other backfill material in approved area until needed for finish backfill and grading.

G. Trench Protection: The CONTRACTOR shall furnish and erect such sheathing, bracing and shoring, and shall furnish necessary signs, barricades, and temporary lighting as may be pertinent for the protection of his work, employees, the public, adjacent structures, and to guard against contingencies which might give rise to delays in the work. Sheathing left in place shall be at the CONTRACTOR's expense. Where trench wall sloping is necessary for safety or other reasons, the Engineer shall be notified to determine if additional strength pipe will be required. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with the CONTRACTOR. Normally, a maximum of 200 feet of trench will be allowed open at any one time. Trench construction and safety shall be governed by the Virginia Occupational Safety and Health Standards for the Construction Industry, Subpart P. No excavation within the VDOT right-of-way or otherwise will be allowed to remain open overnight unless special permission is obtained.

H. Pumping, Bailing, and Draining: The CONTRACTOR shall remove by appropriate means any water which may accumulate or be found in the trenches or other excavations and shall keep the excavations clear of water while work is being installed, unless approval to the contrary is granted by the OWNER.

I. Roadway Protection: No cleated equipment shall be used on pavements. The CONTRACTOR shall be responsible for the repair of any damaged drainage structures. Private roads shall be restored to an equal or better condition of that prior to construction.

3.4 UNDERGROUND UTILITIES

A. General: The CONTRACTOR shall contact the appropriate utility companies and have utilities located prior to starting construction. Locations of existing facilities should be determined by the CONTRACTOR far enough in advance of the construction to provide for modification in design, if required.

3.5 COORDINATION

A. General: The CONTRACTOR shall notify the property owner in advance of commencing work and in the event of the necessity of disrupting utility or other services to such property, he shall notify the owner or responsible person in charge of such utility or other services and arrange for the disruption and restoration or such service in a manner which will result in a minimum of inconvenience to parties concerned.

3.6 BACKFILLING

A. Materials: All backfill materials shall be free from mud, refuse, construction debris, organic material, boulders, frozen or otherwise unsuitable material, select initial backfill shall be free from stones over 3/4 – inch. From one foot above the top of the pipe to the original ground elevation, however, material containing stones up to 5-inches in their greatest dimension may be used, unless otherwise specified. The CONTRACTOR may backfill with the excavated material, provided it meets the conditions as stated above.

B. Gravity and Pressure Sewer Bedding: Bedding shall be required on all gravity and pressure sewer lines, and shall be in accordance with the project details. Bedding material shall extend from the excavated trench bottom to the pipe springline (midpoint). Bedding material shall be compacted to 95 percent of maximum density as measured by ASTM D 698. Special care shall be taken to backfill under the pipe and to tamp this material into place to provide a firm bed. Material shall be deposited on both sides of the pipe simultaneously and compacted into place by tamping. From the centerline of the pipe to a depth of one-foot above the top of the pipe, the trench shall be backfilled with approved material in 6-inch layers and compacted in accordance with the specifications. Mechanical or pneumatic tampers must be used in this operation. Compaction equipment must not come into contact with the pipe.

C. Backfilling to Grade: Initial backfill shall be with select material as stated above and compacted prior to placement of remaining backfill. Backfilling shall be carried up evenly in increments of one foot. Minimum required density shall be the density of the adjacent undisturbed material. Backfill in trenches outside of proposed pavement areas or street rights-of-way, or in other areas when allowed, shall be compacted to a dry density equal to or greater than the density of the undisturbed soil surrounding the trench. Each layer of earth shall be compacted into place by tamping before the next layer is applied. A hydro-hammer shall not be used for compaction. All pipelines shall have a minimum of 18-inches of cover before any rolling equipment is used. Care shall be taken to prevent damage to pipe or other structures during compaction. Damage to pipelines or other structures resulting from compaction shall be corrected by the CONTRACTOR without expense to the OWNER.

E. Fill: Materials for fill areas shown on the plans shall be secured from excavation after rejection of any unsuitable materials. Rock or rocky material may be incorporated into fills if size and shape permit, if placed in lower portion of fills where the stability will not be affected, and if placed in such a manner that the perviousness will not be increased. Material shall be spread in layers with moisture controlled and then compacted to a minimum density as stated above.

F. Finished Surfaces: Uniformly smooth grading of disturbed areas shall be required after backfill and compaction. Road shoulders shall have a minimum depth of 6-inches of VDOT #25 or #26 crusher run aggregate, compacted to a minimum of 95 percent of maximum density as measured by ASTM D 698. Ditches and gutters shall be finished to drain readily. In grass or lawn areas, the last 4-inches of compacted fill will consist of topsoil or an approved soil which will support turf growth after fertilizing and seeding. Settlement or other damage that occurs prior to acceptance of this work shall be repaired and grades satisfactorily re-established.

G. Quality Assurance: The CONTRACTOR will be responsible for and shall repair any settlement in the backfill or pavement for a period of one year after completion of the work.

3.7 BACKFILL TESTING

A. General: Normal testing frequency of compaction testing performed by an independent laboratory shall be at the expense of the CONTRACTOR. Projects initiated and/or funded by the OWNER shall have compaction testing performed at the expense of the CONTRACTOR unless otherwise noted in the project contract.

B. Testing Requirements: The CONTRACTOR shall demonstrate the adequacy of backfill compaction by performing density testing of the completed trench in backfill areas as designated by the OWNER. In grass and lawn areas the density testing shall be performed at two depths for each test location: under the topsoil backfill, and near the maximum trench depth. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D 1556) or liquid displacement methods (ASTM D 2167). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The density of the backfill outside of pavement or other controlled areas shall be equal to or greater than the density of the undisturbed material in the immediate area adjacent to the area under test. The CONTRACTOR shall furnish all equipment, tools, and labor to conduct the testing. Testing shall be performed by an independent testing laboratory qualified to perform such tests and approved by the OWNER. All testing shall be witnessed by the OWNER or OWNER representative. The test shall be repeated until satisfactory results are obtained. The CONTRACTOR shall be charged for all retests at the normal rates for inspection services.

1. Normal Testing Frequency: One test shall be performed within the first 500-feet of pipe installed by each crew. This test will be used as an initial evaluation of the compaction methods being used. Beyond the initial 500-feet, one test shall be performed in each 1,000-foot section of pipe installed or fraction thereof. Testing shall progress as each 1,000-foot section is completed. The location of the test within each section shall be selected by the Inspector. Testing which indicated that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill. Normal testing shall be performed at the CONTRACTOR's expense.

2. Expanded Testing Requirements: If normal testing within a test section indicated unacceptable backfill, the OWNER may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required by the OWNER shall not exceed testing of 4 additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER. If the CONTRACTOR fails to schedule testing on a consistent basis (as per the satisfaction of the OWNER), then payment for work performed will be withheld until such testing is completed. Additional testing beyond that required may be performed by the CONTRACTOR at his expense to further delineate limits of unacceptable backfill.

3. Additional Testing: Testing beyond the normal frequency or expanded testing required which is requested by the OWNER, shall be at the OWNER's expense.

3.8 SITE RESTORATION

A. Replacement of Property: The CONTRACTOR shall restore all pavement, sidewalks, curbing, gutter, fences, poles, culverts, utilities or other such property and surface structures removed or disturbed as a part of the work to a condition equal or better to that before the work began.

B. Pavement Repair and Replacement: Pavement, if disturbed, shall be repaired or replaced in accordance with the technical details.

C. Drainage Improvements: The CONTRACTOR shall restore and/or repair all drainage ways and swales including paved or concrete channels as part of this work to a condition equal to that before the work began. Damaged drainage facilities shall be replaced. Restored ditches and swales shall provide positive drainage from roadways. Drainage restoration within VDOT rights-of-way shall be to the satisfaction of the Virginia Department of Transportation.

D. Cleanup: The CONTRACTOR shall at all time keep the site cleaned to the satisfaction of the Inspector. In all cases, the CONTRACTOR shall "broom" the surfaces of paved streets immediately following backfilling. All surplus materials shall be removed and disposed of from the site of the work unless directed otherwise by the OWNER. Where material is placed on the pavement, a layer of stone dust or sand shall be applied first to facilitate clean-up.

E. Seeding: Shall be in accordance with Section 329200 – Turf and Grasses.

END OF SECTION 312333

SECTION 312513 - EROSION CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

1. Work Included: Furnish all labor, materials, supplies, equipment, and appurtenances necessary for the complete and satisfactory construction and maintenance of the erosion control measures shown on the plans. Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control and storm water drainage measures shown on the plans and as may be deemed necessary by the Owner during construction.

2. Related Sections: Additional Sections of the Documents which are referenced in this Section include:

    1) Section 329200 – Turf and Grasses

3. Temporary Measures: Temporary erosion and sediment control shall be achieved by using the stated measures where indicated on the plans or as required for erosion control. Said measures shall be constructed and made workable prior to beginning site excavation and grading work. Refer to the VESCH for descriptions of additional measures.

4. Permanent Measures: Permanent erosion and sediment control shall be achieved by seeding and landscaping as detailed in Section 329200 – Turf and Grasses. The Contractor shall schedule excavation, fill, finish grading, and seeding work in such a manner as to minimize exposure to erosive forces. Seeding of exposed areas shall commence as soon as possible after excavating, backfilling, grading, or other operations have been completed and shall be maintained until an acceptable stand of turf has been developed. Slope protection along indicated areas shall be installed as soon as the grading is complete.

1.2 REFERENCES

1. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.

2. American Society for Testing and Materials (ASTM):

    1) D 448 — Standard Classification for Sizes of Aggregate for Road and Bridge Construction

3. Virginia Department of Conservation and Recreation Virginia Erosion and Sediment Control Handbook (VESCH):

    1) 3.02 — Construction Entrance

    2) 3.03 — Construction Road Stabilization

    3) 3.09 — Temporary Diversion Dike

    4) 3.13 — Temporary Sediment Trap

5) 3.17 Storm Water Conveyance Channel

6) 3.19 Riprap

7) 3.29 Surface Roughening

8) 3.31 Temporary Seeding

9) 3.32 Permanent Seeding

10) 3.36 Soil Stabilization Blankets & Matting

4. Virginia Department of Transportation - Road and Bridge Specifications (VDOT):

1) 414 Riprap

1.3 QUALITY ASSURANCE

1. General: All erosion control measures shall be in accordance with the Virginia Erosion and Sediment Control Handbook (VESCH), and all revisions and addenda. Methods used on site shall include, but shall not be limited to VESCH Standard and Specifications, Chapter 3.

2. Performance Requirements: The erosion control measures shall be installed such that the erosion of disturbed ground and the siltation of storm drain pipes and inlets will be prevented.

3. Regulatory Requirements: All phases of the construction work shall comply with or exceed the minimum state requirements for controlling erosion and sedimentation from "land disturbing activities" as outlined in the "Virginia Erosion and Sediment Control Handbook" (VESCH), and all revisions and addenda thereto.

1.4 MAINTENANCE

1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until a vegetative groundcover is achieved, which in the opinion of the Owner, is mature enough to control soil erosion and to survive severe weather conditions.

1.5 SUBMITTALS

1. General: Shall be in accordance with Section 013300 – Submittal Procedures.

2. Materials: The Contractor shall submit to the Owner or to the Engineer shop plans or catalog cuts for:

1) Materials list of items proposed to be provided under this Section.

2) Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.

1.6 SITE CONDITIONS

1. Environmental Requirements: Properties and natural waterways adjacent to the site of land disturbance shall be protected from sedimentation by the use of the erosion control measures shown on the plans and in compliance with pertinent erosion and sediment control practices.

2. Vegetation: When conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions, the Contractor shall notify the Owner before planting.

3. Planting Time: See VESCH 3.32 and Section 329200 – Turf and Grasses.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Silt Fence: The silt fence used as a sediment barrier shall utilize extra strength synthetic filter fabrics.

2. Stone: Stone used to construct the temporary construction entrance shall be ASTM D 448 #1 or #2 stone as shown on the plans.

3. Soil Stabilization Mat: Mat shall be a degradable multi-layered soil stabilization blanket consisting of a netting of polyethylene, nylon, vinyl, or other material intertwined with a natural organic or manmade mulch, a jute mesh or excelsoir mat specifically manufactured for maintaining soil slopes until vegetation becomes established. Soil stabilization mat shall be provided by a manufacturer from VDOT's "Approved Products List" as described in VESCH 3.36.

4. Riprap: Riprap shall be a rubble stone riprap, 50 to 150 pounds each, similar to VDOT 414 Class I (50 to 150 pounds) unless otherwise noted on the plans. Stone shall be placed to the depth indicated in accordance with VDOT 414

5. Gravel Outlet Structures: Gravel outlet structures shall be constructed of ASTM D 448 #2 stone or its equivalent.

6. Permanent Seeding: Seeding shall be in accordance with Section 329200 – Turf and Grasses.

PART 3 - EXECUTION

3.1 PREPARATION

1. General: See Virginia Erosion and Sediment Control Handbook for appropriate installation procedures.

2. Surface Preparation for Stabilization Mat: Any storm drainage channel in which soil stabilization mat is to be installed shall be prepared for installation of the mat according to the mat manufacturer's recommendations.

   Any areas which are to be covered with a soil stabilization mat shall be protected from erosion prior to the installation of the mat. The protection shall include, but not be limited to, the installation and maintenance of silt fences, straw bale barriers, and temporary diversion dikes.

3. Rip Rap: Excavation of slopes, ditches, or roadways where riprap is to be placed shall be of sufficient depth to achieve finished grades shown on the plans or details. Rip Rap shall be installed in accordance with VESCH 3.19.

4. Cut and Fill Slope Preparation: Cut and fill slopes shall be constructed in a manner which will minimize erosion, in accordance with the following:

1) All slopes steeper than 3:1 shall require surface roughening, either stair-step grading, grooving, furrowing, or tracking, if stabilized with vegetation, in accordance with VESCH 3.29.

2) Areas with grades less than 3:1 shall have the soil surface lightly roughened and loosened to a depth of 4 inches prior to seeding.

3) Areas which have been graded and will not be stabilized immediately shall be roughened to reduce runoff velocity until seeding takes place.

4) Slopes with a stable rock face do not require roughening or stabilization.

3.2 INSTALLATION AND APPLICATION

1. Silt Fence: Silt fences shall be installed in accordance with the following:

   1) Installed height of silt fence shall not exceed 36 inches.

   2) Filter fabric splice joints shall occur only at a support post, minimum 6 inch overlap, and securely sealed.

   3) Posts shall be spaced a maximum of 10 feet on centers at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without wire support fence, post spacing shall not exceed 6 feet on centers.

   4) A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier. Eight inches of fabric shall be extended into the trench. The trench shall be backfilled and the soil compacted over the filter fabric.

   5) For extra strength filter fabric installation utilizing closer post spacing, the wire mesh support fence may be eliminated. In such case, the fabric is attached to the upslope side of the posts using heavy-duty wire staples, minimum 1 inch long, or tie wires.

   6) Filter fabric shall not be stapled to existing trees.

   7) Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

2. Stone and Riprap:

   1) Stone on the temporary construction entrance shall be installed to a minimum depth of 1 foot.

   2) Rirprap shall be installed to the depth of 18 inches or as indicated on the plans, in accordance with VDOT 414. Stone shall be placed such that top of stone be within +/-2 inches of the finished grades shown on the plans or details.

3. Temporary Diversion Dike:

   1) A temporary diversion ridge of compacted soil shall be located at the top and/or base of sloping disturbed areas in accordance with VESCH 3.09. Dike shall divert storm runoff from higher drainage areas away from unprotected slopes to a sediment trapping facility or to a stabilized outlet.

2) The minimum allowable height measured from the upslope side of the dike shall be 18 inches (except where dike is part of the proposed silt trap).

3) Sideslopes shall be 1.5:1 or flatter. Minimum base width is 4.5 feet.

4) The channel behind the dike shall have positive grade to a stabilized outlet. Channel slope less than or equal to 2 percent shall require no stabilized outlet. Slope greater than 2 percent shall be stabilized in accordance with VESCH 3.17.

4. Temporary Sediment Trap:

1) A small temporary ponding area shall be constructed of earthen embankment with a gravel outlet across a drainage swale to detain sediment laden runoff from the disturbed areas to allow the majority of the sediment to settle out, as per VESCH 3.13. The sediment trap shall be constructed independently or in conjunction with temporary diversion dike.

2) The sediment trap shall have an initial storage volume as indicated on the plans, half of which shall be in the form of a permanent pool (see erosion control plan for required grading).

3) If excavation is required to attain the required storage volume, side slopes shall not exceed 2:1 except for the excavated wet storage area which may be at a maximum 1:1 grade.

4) The outlet for the sediment trap shall consist of a crushed stone section of the embankment located at the low point in the basin. The crest of the outlet shall be at least 1.0 feet below the top of the embankment during peak flow conditions. The outlet shall be constructed as shown in VESCH 3.13.

5) Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to 1/2 the designed volume of the trap. Sediment removed from the basin shall be deposited in a suitable area and in such a manner that it will not erode.

6) The structure shall be checked regularly to insure that it is structurally sound and has not been damaged by erosion or construction equipment. The height of the outlet shall be checked to insure that its center is at least one foot below the top of the embankment.

5. Sediment Trap Embankments:

1) The maximum height of the sediment trap embankment shall be measured from the low point. Minimum top widths and outlet heights for various embankment heights shall be in accordance with VESCH 3.13.

2) Sediment traps shall be removed after the contributing drainage area is stabilized. Sediment trap areas shall be restored to original or proposed final grades.

3) The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat to facilitate cleanout. The pool area shall be cleared.

4) Fill material for the embankments shall be free of roots or other woody vegetation, organic materials, large stones, and other objectionable material. The embankment shall be compacted in 8-inch layers by transversing with construction equipment.

5) The earthen embankment shall be seeded with temporary or permanent vegetation (VESCH 3.31 and 3.32) within 15 days of construction.

6) Construction operations shall be implemented in such a manner that erosion and water pollution are minimized.

7) All cut and fill slopes shall be 2:1 or flatter.

6. Construction Access Routes: Wherever construction vehicle access routes intersect paved public roads, provisions must be made to minimize the transport of sediment (mud) by runoff or vehicle tracking onto the paved surface (VESCH 3.02 and 3.03). Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area. Street washing shall be allowed only after sediment is removed in this manner.

7. Temporary Seeding; Provide temporary seeding in accordance with Section 329200 – Turf and Grasses.

1) Provide temporary seeding of any areas when planting time does not permit permanent seeding within 30 days after completion of subgrades and on soil stockpiles.

8. Straw Bale Barriers: Straw bale barriers shall be placed in a single row, lengthwise, along the contour and embedded in the soil to a depth of three inches. Bales must be securely anchored in place by stakes or steel reinforcing-bars to prevent displacement. Barriers shall be inspected frequently and repair or replacement must be made promptly if needed.

9. Silt Fence: Burlap or geotechnical fabric filter barriers shall be constructed by setting 1 inch x 2 inches x 3 feet stakes and excavating a 4 inches x 4 inches trench along the line of stakes. Staple fabric to stakes and extend into trench. Backfill and compact excavated soil, anchoring fabric.

10. Gravel Outlet Structures: The bases and side slopes of the gravel shall be placed so as to conform to the dike configuration. The invert of the outlet shall be not less than six inches lower than the top of the adjoining earth dike, and the gravel shall extend to the top of the dike. Discharge from the outlet structure shall be onto an already stabilized area or watercourse. The gravel outlet structure shall be inspected for silt accumulation after each runoff-producing rain. If structure ceases to function properly due to silt accumulation, the silt shall be removed and gravel shall be replaced.

3.3 MAINTENANCE

1. Maintenance Service: The erosion control measures shall be maintained by the Contractor until all work covered by this contract is completed and permanent stabilization of disturbed areas has been achieved.

3.4 FIELD QUALITY CONTROL

1. Silt Fence Inspection: Silt fences and filter barriers shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

1) Decomposed or ineffective silt fence or filter barriers shall be replaced promptly.

2) Sediment deposits shall be removed when deposits reach approximately one-half the height of the barrier. Sediment shall be removed from the site and disposed at an approved waste area.

3) Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, then prepared and seeded.

2. Construction Entrance Inspection: The Contractor shall inspect the construction entrance periodically. The stone in the construction entrance shall be replaced when, in the opinion of the Owner, an excessive amount of mud is being carried into the public right-of-way.

3. Disposal: All temporary erosion and sediment control measures shall be disposed of within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed, unless otherwise authorized by the Owner. Trapped sediment and other disturbed soil areas resulting from disposition of temporary measure shall be permanently stabilized to prevent further erosion and sedimentation.

END OF SECTION 312513

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
2. Section 312319 "Dewatering" for dewatering excavations.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review coordination with waterproofing.
8. Review abandonment or removal of excavation support and protection system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
3. Indicate type and location of waterproofing.
4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

C. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
2. The geotechnical report is referenced elsewhere in Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Tiebacks: Steel bars, ASTM A 722/A 722M.

I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

3. Job-Mix Designs: For each job mix proposed for the Work.

B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Fabric: 12 by 12 inches minimum.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each paving material.

B. Material Test Reports: For each paving material, by a qualified testing agency.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or and the Virginia Department of Transportation (VDOT).

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the City of Staunton and VDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Base Course Aggregate: In accordance with Virginia Department of Transportation Road and Bridge Specifications Section 309.

C. Surface Course Aggregate: In accordance with Virginia Department of Transportation Road and Bridge Specifications Section 313.

D. Tack Coat: In accordance with Virginia Department of Transportation Road and Bridge Specifications Section 310.

E. Prime Coat: In accordance with Virginia Department of Transportation Road and Bridge Specifications Section 311.

2.2 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled materials from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

2.3 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes complying with VDOT Road and Bridge Specifications. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan.
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.3 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.2 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.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: 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.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at rate specified on Drawings. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at rate specified on Drawings.

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.

3.6 PAVING GEOTEXTILE INSTALLATION

A. Apply tack coat uniformly to existing pavement surfaces.

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.7 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

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 three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Concrete Paving, including the Following:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 321713 "Parking Bumpers."
4. Section 321723 "Pavement Markings."
5. Section 321726 "Tactile Warning Surfacing."

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.

b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving Subcontractor.
e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10-lb Sample of each mix.

D. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 223.

2.4 CONCRETE MATERIALS

A. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 217.

2.5 CURING MATERIALS

A. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 220.

2.6 CONCRETE MIXING

A. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 CONCRETE PLACEMENT, JOINTS, FINISHING, AND TOLERANCES

A. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 316.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM 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/C 231M, 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 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.

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.

I. Prepare test and inspection reports.

3.7 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of joint sealant and accessory.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. In accordance with The City of Staunton, VA - Manual of Specifications and Standard Details, current edition, Section 02400 and Virginia Department of Transportation Road and Bridge Specification Section 212.

2.2 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.3 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings 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. Seeding.
2. Erosion-control material(s).

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawncare Manager.
    c. Landscape Industry Certified Lawncare Technician.

5. Pesticide Applicator: State licensed, commercial.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 – April 30.
2. Fall Planting: August 15 – October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as indicated on Drawings.

2.2 FERTILIZERS

A. Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the composition indicated on Drawings.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

G. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at rate indicated on Drawings.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

E. Protect seeded areas from hot, dry weather or drying winds by applying mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll,

regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.8 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.9 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 GENERAL

1.01 DESCRIPTION

These general requirements apply to all landscape operations. Refer to specification sections for specific general, product, and execution requirements.

1.02 QUALITY ASSURANCE

A. Comply with all applicable local, state and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.

B. Obtain and pay for all required inspections, permits, and fees. Provide notices required by governmental authorities.

C. Owner shall appoint a qualified representative to oversee the work and assure its adherence to the plans and these specifications. Henceforth, this person shall be designated as Owner's Representative.

1.03 PROJECT CONDITIONS

A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Contact Miss Utility at 800-552-7001. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.

B. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

C. Locate, protect, and maintain benchmarks, monuments, control points and project engineering reference points. Re-establish disturbed or destroyed items at Contractor's expense.

D. Obtain governing authorities written permission when required to close or obstruct street, walks and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.

E. Control dust caused by the work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.

F. Protect existing buildings, paving, and other services or facilities on site and adjacent to the site from damage caused by work operations. Cost of repair and restoration of damaged items at Contractor's expense.

G. Protect and maintain streetlights, utility poles and services, traffic signal control boxes, curb boxes, valves and other services, except items designated for removal. Remove or coordinate the removal of traffic signs, parking meters and postal mailboxes with the applicable governmental agency.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment: As selected by Contractor, except as indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which work is to be performed. Do not proceed with the work until unsatisfactory conditions are corrected.

B. Consult the available records and drawings of adjacent work and of existing services and utilities which may affect work operations, as provided by owner.

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide trees, plants, and ground covers as shown and specified. The work includes:

1. Soil preparation.
2. Trees, plants, and ground covers.
3. Planting mixes.
4. Mulch and planting accessories.
5. Existing plant relocation.

B. Related work:

1. Section 312000: Earth Moving
2. Section 329200: Turf and Grasses.

1.02 QUALITY ASSURANCE

A. Refer to nursery recommendations for soil preparation for individual plant type.

B. Plant names indicated, should comply with “Standardized Plant Names” as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Provide stock true to botanical name. Do not substitute without permission of owner or owners representative.

C. Comply with sizing and grading standards of the latest edition of “American Standard for Nursery Stock.” A plant shall be dimensioned as it stands in its natural position.

For plant material grown in fabric-ground containers, the following chart shall determine root mass size in relation to caliper:

Fabric-ground Suggested Container Diameter	Caliper of Size Plant
10”	1”
12”	1”
14” - 16”	1 ½” -2”
18” - 20”	2” - 3”
22” - 24”	3” - 4”

D. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project.

E. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost to owner. Root systems must meet AAN standards as specified. Plants should not be altered by pruning or other means to meet specifications.

F. Provide “specimen” plants with a special height, shape or character of growth. Specimen trees or shrubs may be tagged at the source of supply. The Owner’s Representative may inspect specimen selections at the source of supply for suitability and adaptability to selected location. When specimen plants cannot be purchased locally, provide sufficient photographs of the proposed specimen plants for approval.

G. Plants may be inspected and approved at the place of growth, for compliance with specification requirements for quality, size and variety.

1.03 SUBMITTALS

A. Submit the following material samples, if requested:

1. Mulch -Bulk or Bagged.

2. Decorative Stone or Gravel -Bag or Bulk

B. Submit the following materials certification, if requested:

1. Topsoil source and pH value.

2. Peat moss, compost, or other organic soil amendments

3. Plant fertilizer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Take all precautions customary in good nursery practice to prepare plants for transport. Workmanship, which fails to meet the highest standards, will be rejected. Spray deciduous plants in foliage with an approved Anti- Desiccant immediately before digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury.

C. Cover plants transported on open vehicles with a protective covering to prevent windburn.

1.05 PROJECT CONDITIONS

A. Work notification: Notify Owner’s Representative at least five (5) working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations. Call Miss Utility to mark underground utilities a minimum of 48 hours before digging.

C. A complete list of plants, including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in

the plant materials list, the planting plans shall govern. Payment shall be based on actual installed plant count.

1.06 WARRANTY

A. Warrant plant material to remain alive and be in a healthy, vigorous condition for a period of one (1) year after acceptance, provided plants are given proper care during this period.

1. Contractor to call for final inspection of plants.

B. Remove and immediately replace all plants, as determined by the Owner's Representative, to be unsatisfactory during the initial planting installation.

C. Replace once, in accordance with the drawings and specifications, all plants that are dead or, as determined by Owner's Representative, are in a severely unhealthy condition within warranty period. Replacements to be installed at next best planting season.

D. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, drought, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting areas; acts of vandalism or negligence on the part of the Owner. Any replacement attributed to these causes must be in addition to the contract amount.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plants: Provide plants typical of their species or variety; with normally developed branches and vigorous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation.

1. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth as necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock." Cracked or mushroomed balls are not acceptable.

2. Container-grown stock shall have grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

a. No plants shall be loose in the container.

b. Container stock shall not be pot bound.

3. If the use of larger than specified plants is acceptable, increase the spread of roots or root ball in proportion to the size of the plant.

4. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size and variety designated in the plant list and according to the AAN Standards for Nursery Stock.

5. Shrubs and small plants shall meet the requirements for spread and/or height indicated in the plant list and be in accordance with AAN standards.

2.02 ACCESSORIES

A. Topsoil for planting beds: Fertile, friable, natural topsoil without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 5.5 to 6.0 and be typical of the area.
   1. Identify source location of topsoil proposed for use on the project.
   2. Provide topsoil free of substances harmful to the plants which will be grown in the soil.

B. Peat moss: Brown to black in color, weed and seed free granulated raw peat or baled peat, containing not more than 9% mineral on a dry basis.

C. Organic Matter- Organic matter can be from peat moss, compost, or locally available organic waste. Organic matter should be free from debris, weed seeds, and insects or diseases which may be harmful to the intended planting.

D. Fertilizer:
   1. Plant fertilizer: Commercial type "A" approved by the Owner's Representative, containing 12% nitrogen, 12% phosphoric acid and 12% potash by weight, ¼ of nitrogen in the form of nitrates, ¼ in form of ammonia salt and ½ in form of organic nitrogen, or as specified.

E. Anti-Desiccant: Protective film emulsion providing a protective film over plant surfaces;; permeable to permit transpiration. Mixed and applied in accordance with manufacturer's instructions.

F. Water: Hoses or other methods of transportation furnished by Contractor. Water to be provided by the Owner at the site.

G. Stakes for staking: Hardwood, 2" x 2" (6-8') long (2x4 pine is permissible).

H. Stakes for guying: Hardwood, 2" x 2" x 24" long.

I. Guying/staking wire: 12- or 14-gauge galvanized wire.

   1. Turnbuckles: Galvanized steel of size and gauge required to provide tensile strength equal to that of the wire. Turnbuckle openings shall be at least 3".

J. Staking and guying hose: Two-ply, reinforced garden hose not less than ½" inside diameter. Shall be uniform in color.

K. Plastic guy material no less than ¼". Shall be uniform in color and level as applied.

L. Twine: Two-ply jute material.

M. Weed control barrier: Rot resistant polypropylene fabric or equivalent, water and air permeable.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine proposed planting areas and conditions before installation. Do not start planting work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Time of planting:

1. Evergreen material: Plant evergreen materials between September 1 and December 1 or in spring before new growth begins. If Owner requires planting at other times, plants shall be sprayed with anti-desiccant prior to digging operations, weather dependent.

2. Deciduous material: Plant deciduous materials in a dormant condition. If deciduous trees are planted in- leaf, they shall be sprayed with an anti-desiccant prior to digging operation.

B. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

C. Locate plants as indicated on drawings. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until Owner's Representative has selected alternate plant locations.

D. Excavate circular plant pits with vertical sides, except for plants specifically indicated to be planted in beds. Provide shrub pits at least twice as wide as the root system and 24" greater for trees. Depth of pit shall be no greater than the root ball depth. Scarify bottom of the pit. Remove excess excavated materials from the site.

E. Provide pre-mixed ground cover bed planting mixture for use around the balls and roots of the plants consisting of five (5) parts existing soil to one (l) part peat moss and lb. plant fertilizer for each cubic yard of mixture or equivalent. Bagged bark professional mixes are an equivalent substitute for peat moss.

F. Provide pre-mixed ground cover bed planting mixture consisting of three (3) parts existing soil to one (l) part peat moss and 1lb. plant fertilizer per cubic yard. Provide beds a minimum of 6" deep. Bagged bark professional mixes are an equivalent substitute for peat moss.

INSTALLATION

A. Set plant material in the planting pit to proper grade and alignment. If Fabric In-ground container material is used, remove fabric bag first. Set plants upright, plum and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material no lower than the finish grade or 2" - 3" above finished grade. No filling will be permitted around trunks or stems. Back fill the pit with existing soil or approved top soil or mix. Form a ring of soil around the edge of each planting pit to retain water.

B. After plants are set, muddle planting soil mixture around bases of balls and fill all voids.
   1. Remove all burlap, ropes, and wires from the collar of balls.

C. Space ground cover plants in accordance with indicated dimensions.

D. Watering: Water planting thoroughly to pull soils against root ball and settle air pockets. Additional soil may be needed, water again to ensure complete compaction.

E. Mulching:
   1. Mulch tree and shrub planting pits and shrub beds with required mulching material 2" - 3" deep immediately after planting. After watering, rake mulch to provide a uniform finished surface.
   2. Mulch ground cover beds with mulch 2" deep before planting.

F. Wrapping, guying, staking:
   1. Wrapping should be done only on an as need basis.
   2. Staking/Guying
      a. Stake/guy should only be used when trees are loose or weak stemmed. (See Staking details on the drawings)

G. Pruning:
   1. Remove or cut back broken, damaged and asymmetrical growth of new wood.
   2. Unless otherwise directed, prune evergreens only to remove broken or damaged branches.

H. Existing plant relocation:
   1. Transplant trees and shrubs designated for relocation to locations shown on the drawings. Prune, dig, ball and burlap, move and plant in accordance with specified tree planting requirements.
   2. Prune, dig, ball and burlap, and move designated trees for relocation to the designated plant storage area for heeling-in of materials until final planting areas are prepared, if required.
      a. Maintain plants in storage areas by bracing plants in vertical position and setting balls in an enclosed berm of topsoil or bark. Water as required to maintain adequate root moisture.
      b. Re-burlap plant balls if required before final transplanting operations.
      c. Move to final locations shown on the drawings and plant in accordance with specified tree planting requirements.
   3. Transplants are not under warranty.

3.03 SUBMITTALS

A. Submit the following material samples, if requested:

1. Mulch -Bulk or Bagged.

2. Decorative Stone or Gravel -Bag or Bulk

B. Submit the following materials certification, if requested:

1. Topsoil source and pH value.

2. Peat moss, compost, or other organic soil amendments

3. Plant fertilizer.

3.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Take all precautions customary in good nursery practice to prepare plants for transport. Workmanship, which fails to meet the highest standards, will be rejected. Spray deciduous plants in foliage with an approved Anti- Desiccant immediately before digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury.

C. Cover plants transported on open vehicles with a protective covering to prevent wind burn.

3.05 PROJECT CONDITIONS

A. Work notification: Notify Owner's Representative at least five (5) working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations. Call Miss Utility to mark underground utilities a minimum of 48 hours before digging.

C. A complete list of plants, including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern. Payment shall be based on actual installed plant count.

3.04 MAINTENANCE

A. Maintenance of installed and accepted plantings will be performed by the Owner.

B. Contractor's maintenance shall include pruning, cultivating, weeding, watering, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease until acceptance.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.

2. Tighten and repair guy wires and stakes as required, only if originally needed.

3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.

4. Water trees, plants and ground cover beds.

3.05 ACCEPTANCE

A. Planted areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.

B. Inspection upon contractors request to determine acceptance of planted areas will be made by the Owner's Representative.

1. Planted areas will be accepted provided all requirements have been complied with and plant materials are alive and in a healthy, vigorous condition.

C. Sections of the work may be accepted when complete upon agreement of the Owner's Representative and the Contractor.

D. Upon acceptance, the Owner will assume plant maintenance.

3.06 CLEANING

A. Perform cleaning during installation and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

Standards For Specifying Herbaceous Perennials In Landscape Designs

INTRODUCTION

The purpose of this work is to aid Landscape Architects, Landscape Designers, and Landscape Contractors in their efforts to utilize herbaceous perennials plants in their designs. As the herbaceous perennial industry is maturing, certain portions are becoming more standardized (i.e. how plants are produced and offered for sale, container sizes, nomenclature). By informing the design portion of our industry of these standardized elements and the way they affect the handling and end-line use of our products, it is our hope designers will find it easier to specify the materials which more succinctly fit their design needs, and installation contractors will find it easier to procure the specified plants in the specified sizes.

Because the success of any industry is based on the satisfaction of the end-line consumer, it is imperative that the grower, designer, and contractor work together as a team toward this end. Though an installation should look good the day it has been completed, it is only through time it will mature into the living environment originally conceived by the designer. The ability of the landscape to mature is based on proper installation in properly prepared soil and on continued good maintenance. Toward this end, this work also includes specifications for soil and recommendations of methods which contractors may employ to achieve the desired results.

I. QUALITY ASSURANCE

A. Nomenclature is now being standardized in the herbaceous perennial industry. This is a difficult and slow task and there is still much disagreement even between generally accepted texts. To the extent possible, botanical (scientific) plant names indicated on designs should comply with:

1. Index Hortensis Volume 1 Perennials
2. Naamlijst Van Vaste Planten
3. Namen der Stauden - ISU
4. Hortus III

Names not listed should conform with those most generally accepted by the Perennial Plant Association and the production trade. Landscape contractors shall provide stock true to name and legibly tagged.

B. Specified pot sizes and plant grades should comply with the standards accepted by the PPA. These standards list minimum dimensions for containers in various classes and define minimum standards for bare root liners, divisions, and field clumps. By adhering to these standards, the designer can be assured that the installation contractor will be able to procure the material as specified.

II. SOIL REQUIREMENTS

A. Soil for herbaceous perennials should be prepared 6 to 8 inches deep (see Section VII,B.4.a. &B., single and double digging), unless otherwise noted. Prior to soil preparation, a representative sample should be taken from each area and analyzed at a university or commercial soil testing laboratory (see II. Section B. page 12). Top soil should be dry, loose, and free of debris. Where hardpan exists beneath the prepared bed, deeper preparation may be specified. Additionally,

drainage tile may be specified The landscape contractor should immediately notify the landscape architect or landscape designer if any beds do not drain properly.

B. A representative soil sample should be tested for pH, organic matter content, pounds per acre available P2O5 (Phosphate) and pounds per acre available K2O (potash). Based on the laboratory report, the soil should be amended to the following minimum standards, unless otherwise noted:

pH: 5.5 to 6.5

Organic Matter: 5%

Phosphate: 50 Lb./Acre

Potash: 120 Lb./Acre

III. AMENDMENTS

A. Organic matter can be from peat moss, compost, or locally available organic waste. Organic matter should be free from debris, weed seeds, and insects or diseases which may be harmful to the intended planting.

B. Synthetic fertilizers, if preferred by the contractor, should be specified to provide the nutrients as required by the soil test. They should be delivered to the job site in their original packaging with legible, intact labels indicating nutrient content and source. Labels should be checked prior to use and a sample may be requested for laboratory analysis.

C. Natural fertilizers include minerals, such as rock phosphate or greens and as well as those usually marketed as “organic”. When these sources of nutrients are preferred, they shall be specified in type and quantity to provide the nutrients as shown necessary by the laboratory soil test. Standardized, commercial fertilizers shall be delivered to the site in their original packaging with legible intact labels showing nutrients analysis. Where non-commercially process manure or other organic waste is specified for its assumed nutrient content, samples must be submitted by the landscape contractor to a commercial laboratory for analysis so the nutrient levels can be assessed prior to application and a proper application rate can be determined.

D. Limestone shall be specified as either ground agriculture limestone or dolomite limestone where magnesium deficiencies exist. Limestone provided to the site by the landscape contractor shall be provided in the original packaging, legibly labeled with fineness and liming ability shown. A sample may be requested for laboratory verification.

E. Sulfur, where required to lower pH, may be specified as either ground sulfur (flowers of sulfur) or iron sulfate where toxicity is not a problem. The landscape contractor shall deliver the sulfur to the site in its original container with legible label indicating its quality. A sample may be required for laboratory verification.

IV. PLANT SPECIFICATIONS

A. Herbaceous perennial plants should be specified for design by the container class and size (i.e. 2¬ inch square container or 1 quart container, etc.) or, if bare root, by grade as accepted by the Perennial Plant Association and the production trade (i.e. 1-eye division, 2-3 eye division, field clump, etc.).

B. Herbaceous perennials should be specified by type:

1. Container-grown - grown to a specified size in a container.

2. Bare root - purchased free of any growing medium regardless of growing method.

3. Field-potted - field-grown plants which are potted for delivery as they are dug from the field.

V. SUBMITTALS

A. After preparation, a sample of the planting soil shall be submitted to the landscape architect or landscape designer prior to installation of the plants. Additional preparation and addition of additional organic matter may be required based on the physical properties of the sample submitted. A separate sample from each planting bed shall be submitted.

B. A sample of the organic matter specified shall be submitted to the landscape architect or landscape designer for approval prior to use. A laboratory analysis may be requested if deemed necessary.

C. Prior to use, labels of all soil amendments shall be inspected by the landscape architect or landscape designer to verify compliance with the design specifications. Samples may be requested for laboratory analysis.

D. Each separately containerized plant brought to the site shall be labeled within reason. Flats of the same plants may have one label per flat. Each bundle of bare root plants shall be labeled. These labels must show the botanical name of the plant. The landscape architect or landscape designer shall inspect the labels, container sizes, and division sizes of bare root plants for compliance to the design specifications prior to planting. The landscape architect or landscape designer shall also verify that the plants delivered to the site are labeled true to name. Upon acceptance of the plants by the owner, the landscape contractor shall provide written maintenance procedures for maintenance of the plants.

Following the installation, the landscape contractor shall provide the landscape designer with a copy of the original plan noting any site adjustments to that original plan.

VI. PRE-PLANTING AND POST-PLANTING INSTRUCTIONS

A. Pre-planting.

1. Plants shall be brought to the site the day they are to be installed, if possible. If situations arise where earlier delivery can't be avoided of if planting is delayed after the plants have been delivered, they shall be stored where they can be properly watered, sheltered from direct sunlight, and protected from mechanical damage by construction equipment, animals, etc. If storage needs to be more than two days, the plants shall be separated far enough from each other to provide good air circulation to their tops, reducing the risk of fungus. Bare root plants which must be held shall be healed-in where they can be watered as needed.

2. All plants shall be watered thoroughly and allowed to drain prior to planting.

3. While planting, bare root plants must be protected from hot sun and drying wind by shading them with burlap, landscape fabric, straw or other breathable material. Plastic is unacceptable. Containerized plants must be left in their containers until each is planted. They shall not be removed from the containers to be laid out on the bed where sun and wind will damage the roots prior to planting.

4. Any dead or damaged plant parts shall be removed from the plants upon planting.

B. Post-planting

1. Herbaceous perennials planted during the active growing season should be protected from hot midday sun with proper shading. Shading may be removed after three days, but shall be replaced if wilting occurs.

C. Mulching is an option which may be specified for artistic reasons, water conservation, weed control or erosion control. Where mulching is specified, the mulch must be pulled away from the stems and crowns of herbaceous perennials to reduce the occurrence of rot or rodent damage. Mulch thickness should be 2 inches or less.

VIII. MAINTENANCE

A. The landscape contractor is responsible for the maintenance of the herbaceous perennials from the time they are brought onto the job site until they are planted and accepted by the landscape architect or landscape designer.

1. Plants shall be watered often enough to prevent wilting prior to planting. After planting, they shall be watered initially to settle the soil, then to prevent wilting and to allow them to become established on the site.

2. The beds shall be free of weeds at planting time and shall be maintained weed free by the contractor until the planting is accepted by the client.

3. Should insects or diseases attack the plants after installation and prior to acceptance of the planting, appropriate pesticides shall be properly applied to correct the situation.

4. The beds should be checked regularly for soil settling which may expose the root balls or otherwise endanger the health of the planting. Should this occur, the contractor shall correct the settling problems.

5. Newly planted herbaceous perennials may be heaved out of the ground by alternate freezes and thaws. Should this occur prior to acceptance of the planting, the contractor shall re-set those affected plants.

6. Any noted defects, such as reversions, errant growth or color not typical for the species or cultivar, shall be brought to the attention of the landscape architect or landscape designer. The recommendations of the landscape architect or landscape designer shall be followed to correct the situation. Recommendations may include removal of the entire plant.

B. The client or the client's assigned agent becomes responsible for the maintenance of the plants after the planting has been accepted by the landscape architect or landscape designer. Failure to properly maintain the planting shall void any warranty.

1. The client shall water the plants to prevent wilting. The schedule will vary with the growth of the plants and prevailing climate. Generally, new plantings will need to receive 1 inch of water per

week. A rain gauge should be placed in the planting to catch both rainfall and irrigation water to verify the amount of application.

2. The client shall properly pinch, prune, and deadhead the herbaceous perennials as needed and as required to meet the aesthetic goal of the planting.
3. The client shall maintain the planting free from competing weeds.
4. The client shall regularly inspect the planting for insects and diseases, notifying the landscape architect or landscape designer of any noted occurrences. If pesticides are deemed necessary, they shall be applied according to the manufacturer's recommendations.
5. After the acceptance of the planting, the client is responsible for correcting any settling of the planting beds.
6. After acceptance, the client is responsible for setting any plants which are heaved out of the ground in whole or in part by climate changes.
7. Unsatisfactory performance of the herbaceous perennials noted by the client after acceptance of the planting should immediately be brought to the attention of the landscape architect or landscape designer.

IX. WARRANTY

All plants will be guaranteed to be true to name as labeled and free from insects, diseases, and mechanical damages when delivered to the site. All plants will be guaranteed to resume active growth in the appropriate season and to survive for a minimum of one year after acceptance by the client, provided the recommended maintenance procedures are followed by the client. Maintenance includes, but is not limited to watering, fertilizing, mulching, pruning, protecting from unseasonable weather and all other normal cultural practices.

END OF SECTION 329300

SECTION 330136 – TELEVISION INSPECTION OF SEWER LINES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: This section includes all the equipment, labor, and materials necessary to perform all work for television inspection of sewer lines.

1.2 SUBMITTALS

A. Submit a written description of procedures to be used to the Owner, including product literature for all digital video equipment including, but not limited to cabling, camera, monitor, footage counter, digital video titling device, and recorder.

B. Submit a written/printed copy of television inspection logs to the Owner. Logs shall record defects according to NASSCO's Pipeline Assessment and Certification Program (PACP) or/and Manhole Assessment and Certification Program (MACP).

C. Submit 2 copies of visual and audio recording to the Owner. The Owner will review the inspections, not for accuracy of content, but to make sure that the required information is provided and the recording is of acceptable quality. If the Owner determines that the recording is defective or not of adequate quality, the Contractor shall TV inspect again at the Contractor's expense.

1.3 QUALITY ASSURANCE

A. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.

B. The Contractor shall comply with the latest revision of the Virginia Occupational Safety and Health Standards for the Construction Industry as adopted by the Safety and Health Codes Commission of Virginia.

C. The Contractor shall comply with Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, "Virginia Erosion and Sedimentation Control Handbook," latest revision.

D. The television inspection shall be performed one section of line at a time

E. Inspection shall be performed in accordance with NASSCO's Pipeline Assessment and Certification Program (PACP) or/and Manhole Assessment and Certification Program (MACP).

1.3 COORDINATION

A. The contractor shall completely remove and dispose of all dirt, debris, rubbish and surplus, and unsuitable materials at the end of each work day at no additional cost to the OWNER.

B. Whenever the contractor desires to use a hydrant for water supply, the contractor shall obtain the permission of the owner. All costs associated with the use of water supplied from hydrants shall not be paid for separately but shall be deemed to be included in the bid. Operation of hydrant shall be in accordance with the Town of Crewe Backflow Prevention Program. Use of an RPZ device or air gap is required.

PART 2 – PRODUCTS

2.1 DIGITAL VIDEO SYSTEM

A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor, and other components of the digital video system shall be capable of producing picture quality to the satisfaction of the engineer; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

B. Recordings of all sewer line inspections shall be made on DVD. The audio portion of the composite digital video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.

C. A footage counter device, which measures the distance traveled by the camera in the sewer, shall be accurate to plus or minus 2 feet in 1,000 feet.

D. Digital video equipment shall include genlocking capabilities to the extent that computer generated data (i.e., footage, date, size, address and location, etc.) as determined by the Owner can be overlaid onto digital video, and both indicated on the television monitor and permanently recorded on the digital inspection.

PART 3 – EXECUTION

3.1 TELEVISION INSPECTION OF SEWER LINES

A. Move the camera through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case pull television camera at a speed greater than 30 feet per minute. Use manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions to move the camera through the sewer line.

B. If, during the inspection operation, the television camera will not pass through the entire section, set up equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire section, the obstruction shall be cleared by cleaning, root removal, or point repair as directed by the Engineer and the section reinspected.

C. When manually operated winches are used to pull the television camera through the line, set up telephones or other suitable means of communication between the two manholes

of the section being inspected to insure good communications between members of the crew.

D. Measurement for location of defects shall be aboveground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Check accuracy of the distance meter by use of a walking meter, roll-a-tape, or other suitable device. The accuracy shall be satisfactory to the Engineer.

E. The camera image shall be down the center axis of the pipe when the camera is in motion. The Contractor is required to provide a 360-dregree radial view of the pipe interior using a camera with pan and tilt capabilities for 8-inch diameter and larger pipes. Points of interest shall also be digitally recorded and shall include, but not be limited to, defective joints, ovality, debris, sediment, cracked pipes, holes, or blockages.

3.2 DOCUMENTATION OF THE TELEVISION RESULTS

A. Television Inspection Logs: Develop and keep printed location records that clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, record other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features.

B. Photographs: Take digital photographs or digital video stills of any defects or points of interest recorded on the inspection report. If no defects are present provide one still image of pipe for information purposes.

C. Videotape Recordings: A visual and audio recording of all areas of the lines shall be performed and produced in a format that may be replayed in a standard CD/DVD player/recorder device.

END OF SECTION 330136

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.

2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.; DMD Div.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. JCM Industries.
    e. Smith-Blair, Inc.
    f. Viking Johnson.
    g. Approved Equal.

3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Manufacturers: Subject to compliance with requirements.

2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Co.
    d. Approved Equal.

3. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities.
    e. Approved Equal.

3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Hart Industries, International, Inc.
    e. Watts Water Technologies, Inc.
    f. Zurn Plumbing Products Group; Wilkins Div.
    g. Approved Equal.

3. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.

    a. Pressure Rating: 250 psig (1725 kPa) at 180 deg F (82 deg C).
    b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Water Technologies, Inc.
    e. Approved Equal.

3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.

    a. Pressure Rating: 300 psig (2070 kPa).
    b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.
    e. Approved Equal.

3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.

    a. Pressure Rating: 150 psig (1035 kPa) minimum.
    b. Gasket: Neoprene or phenolic.
    c. Bolt Sleeves: Phenolic or polyethylene.
    d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.
    c. Approved Equal.

3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.

    a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Perfection Corporation.
    b. Precision Plumbing Products, Inc.
    c. Victaulic Company.
    d. Approved Equal.

3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

    a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick, polished brass or aluminum.
2. Material: 0.0375-inch- (1-mm-) thick stainless steel.
3. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).

2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
3. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. 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.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic 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.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099600 "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish per Section 099600.

C. All pipes, valves, flow meters, and any other portions of water main or ferrous metals exposed inside of the pump station or water treatment plant shall be painted.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    d. At manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

SECTION 331113 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

B. References to details pertain to standard details for water lines and appurtenance installation, as shown on the construction drawings.

1.2 SUMMARY

A. This Section includes water-distribution piping and specialties for the following:

1. Work to be done hereunder shall include furnishing of all labor, materials, tools, transportation, supplies, plant, equipment, and appurtenances necessary for complete and satisfactory construction of water mains, as shown on Drawings or Specifications, as approved by the Owner, complete and ready for service.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. The following are industry abbreviations for plastic materials:

1. PVC: Polyvinyl chloride plastic.

2. PE: Polyethylene plastic.

3. DIP: Ductile Iron Pipe

1.4. REFERENCES:

The work shall comply with most recent standards or tentative standards as published at the date of the contract and as listed in these specifications using the abbreviation shown:

American Society for Testing and Materials.....ASTM
American Water Works Association..... AWWA
American Association of State Highways and Transportation Officials .....AASHTO
Virginia Department of Transportation.....VDOT
National Sanitation Foundation..... NSF

Chain Link Fence Manufacturers Institute..... CLFMI
Occupational Safety and Health Administration ..... OSHA

1.4 SUBMITTALS

A. Product Data: For the following:

1. Piping and specialties.
2. Valves and accessories.
3. Fire hydrants.
4. Flushing hydrants.
5. Casing pipe.
6. Air relief valves.

B. Coordination Drawings: For piping and specialties, including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

C. As-Built Drawings: Marked-up drawings shall be given to Engineer upon project completion.

D. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. Include the following:

1. Valves.
2. Fire hydrants.
3. Flushing hydrants.
4. Air relief valves.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated.

B. Regulatory Requirements:

1. Comply with Owner requirements, including tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Comply with appended standard details of Owner.

E. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 61 for materials for piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Engineer's written permission.

1.8 TRENCH PROTECTION

A. Contractor shall furnish and erect sheathing, bracing, and shoring, and shall furnish necessary signs, barricades, and temporary lighting, as may be pertinent for protection of work, employees, public, and adjacent structures, and to guard against contingencies which might give rise to delays in work. Sheathing left in place shall be at Contractor's expense. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with Contractor. Unless otherwise approved by Engineer, maximum of 200 feet of trench will be allowed open at any one time. No trench will remain open overnight unless authorized by Engineer.

1.9 UNDERGROUND UTILITIES

A. Contractor shall contact the appropriate utility companies and have utilities located prior to starting construction. Locations of existing facilities should be determined by Contractor far enough in advance of construction to provide for modification in design, if required. Contractor shall call “Miss Utility”, 811.

1.10 BLASTING

A. Blasting shall be done in strict accordance with Virginia Statewide Fire Prevention Code (VR 394-01-6), latest edition. Contractor shall adhere to requirements of local municipalities and shall notify Owner, County, and City prior to any blasting.

1.11 CLEARING AND EROSION CONTROL

A. Contractor shall be responsible for complying with all provisions of erosion and sediment control plans and notes, including construction, installation, and maintenance of all mechanical and vegetative erosion and sediment control measures for the duration of project. If unforeseen erosion and sediment problems arise during the construction, Contractor shall implement corrective measures acceptable to Engineer.

B. Siltation and pollution control requirements for installation, operation, maintenance, and removal shall be in accordance with Virginia Erosion and Sediment Control Manual, latest edition, and Virginia Department of Transportation Road and Bridge Specifications, latest edition.

C. Only that portion of right-of-way or easement actually needed for construction shall be cleared or used by heavy equipment, unless directed by Engineer. In no case shall clearing or debris from clearing operations be taken past right-of-way or permanent easement lines onto private property. Areas disturbed by construction operations shall be protected from erosion by suitable means outlined in the “Virginia Erosion and Sediment Control Handbook.” Equipment and materials shall be stored only in approved areas.

1.12 TRAFFIC

A. All traffic control and directional signs shall be supplied by the Contractor. Traffic control shall conform to the latest edition of Uniform Manual for Traffic Control Devices, the Owner, VDOT, and local regulations. Placement of excavated material on existing pavement shall be permitted upon approval of a written request to VDOT and provided a stone dust or sand layer is first placed on the pavement. No cleated equipment shall be used on pavements. Road drainage shall not be clogged, and shoulders, ditches, roadside drainage facilities, and pavement affected by the grading operations shall be maintained in a condition satisfactory to VDOT. Traffic shall not be blocked or rerouted without permission of VDOT. Where one way traffic is permitted to be maintained, it shall be flagged 24 hours per day. Traffic shall at all times be properly protected by adequate lights, barricades, and signs, and also flagging personnel when needed.

1.13 INSTALLATION WITHIN VDOT RIGHT-OF-WAY

A. Contractor shall install water main within Virginia Department of Transportation right-of-way as required by Owner and approved by VDOT.

1.14 SEPARATION OF WATER AND SEWER LINES

A. Parallel Installation: Water lines shall normally be separated from sanitary sewers horizontally by a distance of 10 feet. This distance shall be measured from outside of pipe to outside of pipe. When local conditions prevent a horizontal separation of 10 feet, bottom of water line shall be a minimum of 18" above top of sewer. Where this vertical separation cannot be achieved, sanitary sewer shall be constructed of AWWA-approved water pipe, pressure tested in place to 150 psi without leakage prior to backfilling. The Contractor is required to receive prior Engineer approval of the construction methods whenever normal separation installation conditions can not be achieved.

B. Crossings: Water lines crossing house, storm, or sanitary sewers shall provide separation of at least 18 inches between bottom of the water line and top of sewer. If this vertical separation is not possible, sanitary sewers shall be constructed and tested per Section 1.14.A.

C. When local conditions require water lines to pass under such sewers, adequate structural support shall be provided for sewer to prevent excessive deflection. Also, length of water pipe shall be centered at point of crossing, and a vertical separation of at least 18 inches shall be provided between bottom of the sewer and top of water line. In this case, sanitary sewers passing over shall be constructed and tested as noted in Section 1.14.A.

D. No water pipe shall pass through or come in contact with any part of a sewer or sewer manhole.

1.15 SAFETY

A. All pertinent safety regulations, including federal and state OSHA standards, shall be followed. In addition, all safety precautions noted on manufacturer's product data sheets and labels shall be observed for both material and equipment. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with work.

1.16 OSHA REQUIREMENTS

A. Contractor shall be responsible for performing all excavation, pipe installation, and backfilling, in accordance with 1990 OSHA Excavation Standards 29 CFR Part 1926, Subpart P – Excavations. Contractor's responsibility also extends to providing a "Competent Person", as defined by OSHA regulation referenced above, on job site.

1.17 WASTE AREAS

A. Disposal of unsuitable and surplus material will be carried out in accordance with Virginia Department of Transportation Road and Bridge Specifications, Section 106.04, except that Contractor shall be responsible for obtaining rights to any waste area for disposal of unsuitable or surplus material either shown or not shown on plans. All work in disposing of such material shall be considered incidental to work

1.18 CLEANUP

A. Before final acceptance, all borrow pits, waste areas, storage areas, and all grounds occupied by the Contractor in connection with the work, shall be cleaned of all rubbish, excess materials, and temporary structures, and all parts of the work shall be left in a neat and presentable condition.

1.19 COORDINATION

A. Coordinate connection to water mains with Owner.

B. Contractor shall notify owner of property upon which work is to be performed in advance of commencing. In event of necessity of disrupting utility or other services to such property, Contractor shall notify owner of such utility or other services and arrange for disruption and restoration of such service in a manner which will result in a minimum of inconvenience to parties concerned. Contractor shall cooperate fully with Owner to effect proper coordination and progress to complete Project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required by Owner shall be anticipated by Contractor to provide ample time for inspection, investigation, or preparation of instructions.

C. No valve, hydrant, or other appurtenance on existing water lines shall be opened or closed for any purpose by Contractor. Any opening or closing of valves, hydrants, or other appurtenance

shall be by Owner. Contractor shall notify the Owner at least 48 hours prior to need to open or close any appurtenance, except in emergencies, at which time the Owner shall be notified immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the 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, the manufacturers specified.
3. All materials and equipment provided shall be compatible with materials and equipment already in Owner system, and shall be new and in first class condition.

2.2 PIPING MATERIALS

A. As indicated on the design plans, pipe material is to be installed as called out. Water main pipe installed through casing pipe shall have locked gaskets or restrained joints such as “Mega-Lug”, “AquaGrip”, “Lock Tyton”, or Approved Equal.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, Pressure Class 350, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated. Nominal 18-feet or 20-feet lengths.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

    b. Cement Lining: AWWA C 104

2.4 PVC PIPE

A. PVC (SDR 14) C900 pipe shall be Pressure Class 305 polyvinyl chloride plastic furnished in 20-foot nominal lengths. Pipe shall have a 4 to 1 sustained pressure safety factor at recommended maximum working pressure. Pipe shall conform to AWWA Specification C.900 for PVC pressure pipe, 4-inch through 12-inch. Joints shall be push-on type with rubber rings

conforming to ASTM D3139 and ASTM F477. PVC pipe will only be allowed on line sizes 8" and smaller.

B. Small Diameter Pressure Pipe: PVC pipe 4-inches in diameter and smaller shall be Class 250 polyvinyl chloride plastic. Pipe shall be manufactured in accordance with ASTM D 2241 for PVC pressure rated pipe. Joints shall be manufactured in accordance with ASTM D 3139. Rubber rings shall be manufactured in accordance with ASTM F 477. Pipe shall be certified by the National Sanitation Foundation for Potable Water Service (NSF No. 14) and the same shall be so indicated on the pipe. Pipe shall be equal to Yelowmine as manufactured by Certain Teed or Aquamine as manufactured by Victaulic, or approved equal.

C. Schedule 40 PVC: Drain, waste, and vent piping shall be Schedule 40, Type 1, Grade 1, plain end conforming to ASTM D1784 and ASTM D1785 with solvent weld joints and fittings, as called for on the plans.

D. Schedule 80 PVC: Drain, waste, and vent piping shall be Schedule 80, conforming to ASTM D1785 with solvent weld joints and fittings, as called for on the plans.

2.5 POLYETHYLENE (PE) PIPE

A. High Density PE (HDPE): HDPE shall be used in accordance with specifications and installation shall follow the manufacturer's and Plastic Pipe Institutes' recommendations. Pipe and heat-fusion fittings shall be PE 3408 high density polyethylene and conform to latest revision of AWWA C 901 and AWWA C 906. Pipe shall have a minimum standard dimension ratio (SDR) of 11. HDPE pipe installed by horizontal directional drilling (HDD) shall be provided with a 12 gauge solid copper wire for pipe location purposes.
   1. Drilling Fluid: Contractor shall utilize a bentonite drilling mud, which is compatible with the environment. Waste oil or environmentally non-compatible polymers cannot be part of composition.
   2. HDPE Joints
      a. Use Butt fusion joining techniques for joining pipe segments installed by HDD.
      b. When joining HDPE pipe at ends of directional drilling runs, fusion bond to the adjacent pipe section. Use Butt fusion, Socket fusion, or Electrofusion Coupling joining technique.
      c. Mechanical couplings are not permitted for joining of directionally drilled pipe sections.
      d. Connect to other pipe materials as indicated by manufacturer.
      e. Contractor shall certify that all joining operations are conducted by personnel trained by the joining equipment manufacturer. Certification shall be provided to the Engineer prior to construction.

B. Polyethylene (PE) Pressure Tubing: PE tubing shall be pressure class 200, copper tubing size, meeting the requirements of AWWA C 901. In water applications, PE tubing shall only be used for service lines and shall be 1-inch in diameter.

2.6 FITTINGS

A. All fittings for pipe shall be mechanical joint, ductile iron or cast iron, in compliance with AWWA C 104, C 110, or C 153. When connecting any PVC pipe to a cast iron bell fitting, pipe end shall be prepared for installation in accordance with manufacturer's directions.

2.7 PROTECTIVE COATING

A. Ductile iron pipe and fittings shall be cement lined and sealed in accordance with AWWA C.104. Underground metal pipe, fittings, and accessories, and metal piping in casings shall also have an exterior coat of a bituminous material.

2.8 JOINING MATERIALS

A. All joint assembly shall be in accordance with manufacturer's directions. Restrained joints, such as "Mega-Lug", "AquaGrip", "Lock Tyton," or approved equal, may be used for ductile iron pipe upon approval by Engineer. Where such joints are used, concrete anchorage shown on the Drawings will not be required.

2.9 LUBRICANT

A. Lubricant for joints shall be that supplied by the manufacturer of the pipe being used. If PVC pipe is used, the lubricant for PVC pipe shall be used at joints with valves, fittings, hydrants, or other pipe materials. With PVC pipe, no lubricant harmful to polyvinyl chloride plastic shall be used.

2.10 PIPE ENCASEMENT FOR CROSSINGS

Steel casing pipe shall conform to the Materials Standards of ASTM Designation A-139, Grade B, or approved equal. Only new prime pipe will be permitted. Wall thickness will be as shown on the plans. The pipe shall have an exterior coat of bituminous material. Casing pipe and joints shall be of leak proof construction so as to prevent leakage of any substance from the casing throughout its length.

2.11 GATE VALVES

A. Refer to Section 331250 – Valves.

2.12 AIR RELIEF VALVES

A. Refer to Section 331250 - Valves.

2.13 BLOW-OFF ASSEMBLY

A. Blow-off valves shall be installed at low points in the water line or as selected by the Owner. Blow-offs shall be field assembled in accordance with the details on the design plans, or shall be provided in the form of a box hydrant. Two-inch blow-off valves shall be installed at the end of water lines. Concrete bulkhead anchors shall be provided at all blow-off assemblies as shown in the Standard Details.

2.14 HYDRANTS

A. General: Fire hydrants shall be traffic type with safety flange protection conforming to AWWA C.502 and shall have not less than 6-inch diameter barrel, 5 ¼-inch minimum hydrant valve and a measured loss of not more than 2.5 psi through the hydrant at 600 gpm. Hydrants shall have 6 inch mechanical joint connection to the water main, two 2 ½-inch hose outlets, and one 4 ½-inch pumper outlet and nozzle threading shall be National Standard. Hydrants shall be so designed that if broken off, hydrant valve will remain closed. Direction of opening shall be left (counterclockwise) with 1 ½-inch pentagon-shaped operating nut. Such hydrants shall have a working pressure of not less than 250 psi. Hydrants shall be Mueller A-423, American Darling B 84B, Kennedy K81D, or approved equal.

2.15 CONCRETE

A. Miscellaneous concrete shall be Type A-3 conforming to VDOT Specifications and Section 033000.

2.16 METER/VALVE VAULTS

A. General: All meters enclosed in a meter vault shall be equipped with approved touch read or radio read apparatus as indicated on the plans. Meter vaults constructed of masonry brick or block will not be acceptable.

B. Large Vault: Chamber for meter or control valve shall be equal to VDOT JB-1 or precast utility vaults approved by Engineer. Minimum dimensions and section details shall be as given in the plans for the size meter/valve assembly required. Joints on precast unit shall be sealed with an asphaltic butyl compound to make them watertight. Access hatch shall be Bilco J-4 series doorway, Halliday, or approved equal or Bilco JH-20, Halliday, or approved equal in traffic areas.

2.17 TAPPING DEVICES

A. General: All wet taps on water lines shall only be made with approved tapping sleeve or tapping saddle.

B. Tapping Sleeves: Tapping sleeves are required for connecting to 2-inch and larger water mains and shall be full circle stainless steel sleeves with approved tapping valve included as part of

the tapping sleeve installation. All tapping sleeves are to rated for a working pressure of 250 psi.

2.22 TIE RODS

A. Shall be ¾-inch thread steel rods for hydrant clamping, galvanized or otherwise rustproof-treated. Compatible washers and nuts shall be similarly rustproof-treated. Tie bolts shall be A36 steel.

2.23 STONE

A. Stone for repair of gravel road shoulder shall be VDOT #25 or #26.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 EXCAVATION AND TRENCH PREPARATION PIPING

A. Width: Width shall be sufficient to allow laying without walking or standing on pipe and shall not be less than six inches on each side of pipe's largest diameter. The maximum clear width at
top of pipe shall not be more than outside diameter of the pipe plus two feet.

B. Bell holes shall be excavated to accommodate each bell.

C. Rock Excavation: Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves, and fittings. Before pipe is laid, subgrade shall be made by backfilling with approved material and shall be tamped and graded. Commercial stone shall be as shown on the plans and standard details. or shall be VDOT #26 for ductile iron pipe and #10 for PVC pipe when not specified.

D. Excavation to Grade: Trench shall be excavated so as to provide a uniform and continuous bearing and support for pipe on solid and undisturbed ground between bell holes. Any part of bottom of trench excavated below specified grade shall be brought back to grade with approved material, thoroughly compacted. Finished subgrade shall be prepared accurately by means of hand tools.

E. Unsuitable Material: Wet or otherwise unsuitable soil at subgrade shall be removed and replaced with approved sound materials as part of original contract cost and at no additional cost to the Owner. Excess or unsuitable material shall be legally disposed of by Contractor.

F. Topsoil Storage: Topsoil to be used in landscaping shall be stockpiled separately from other backfill material.

G. Trench Protection: Contractor shall furnish and erect such sheathing, bracing, and shoring, and shall furnish necessary signs, barricades, and temporary lighting as may be pertinent, for protection of the work, employees, public, and adjacent structures. Sheathing left in place shall be at Contractor's expense. Maximum of 200 feet of trench will be allowed open at any one time. No excavation within VDOT right-of-way or elsewhere will be allowed to remain open overnight unless special permission is obtained.

H. Pumping, Bailing, and Ditching: Contractor shall remove by appropriate means any water which may accumulate in trenches or other excavations and shall keep excavations clear of water while work is being installed.

I. Road or Driveway Crossings:

1. All VDOT road crossings must be bored unless otherwise shown on plans. Driveways may be open cut unless otherwise shown on plans. All driveways must be restored to conditions equivalent to existing conditions.

2. Wherever road pavement is to be cut, not over one-half width shall be disturbed at one time. On crossings, first opening shall be completely restored to satisfactory travelable condition before second half can be opened. Where this is not possible, steel crossing plates must be used to maintain access at all times. Where pavement is disturbed, or deemed weakened, it, in its entirety, or such portions of it as deemed desirable by VDOT shall be restored or replaced in a manner directed by and to the satisfaction of VDOT.

3. When pavement must be cut, cut shall be made in a straight line, parallel to pipe and six inches wider than trench, on each side, so that an undisturbed shoulder will be provided under new work. Sidewalks or curb and gutter disturbed by construction shall be removed and replaced at existing joints. Cutting shall be done neatly so that a uniform, straight joint will result to provide a bond with original concrete or pavement.

J. Erosion and Siltation Control: Within all easements and rights-of-way, straw barriers, silt fencing, settlement basins, brush barriers, and all other means necessary for adequate erosion and siltation control are to be utilized. All work shall be done according to the latest edition of the Virginia Erosion and Sediment Control Handbook.

3.3 HORIZONTAL DIRECTIONAL DRILLING (HDD)

A. Background: Directional drilling is a two-stage process consisting of drilling a pilot hole through the ground, and pulling back a pipe while the drilling pipe is removed. A lubrication system mixes and pumps bentonite through a hollow stem drill rod to lubricate the hole, assists in the cutting of the earth and rock, and stabilizes the bore hole. When the drill rod exits at the correct location, a back reamer is installed to the drill rod to enlarge the hole. The pipe is attached to the reamer with a swivel installed between the two to ensure that the rotating action of the reamer is not transmitted to the pipe or cable being pulled back. During

the pull back, drilling fluid is pumped through the hollow stem drill rod and is injected at the reamer to assist in the cutting and lubrication of the hole, the reduction of friction of the outside of the pipe, and the stabilization of the bore hole.

B. Contractor Qualifications: Contractor shall be actively engaged in horizontal direction drilling for a minimum of three years, and must have completed at least five projects in the last two years of similar size and type as required for the installation. Field supervisory personnel shall have at least three years of experience in the performance of the type installation to be done. Experience information shall be submitted to the Engineer. Information including the following shall also be submitted to the Engineer: size & capacity of equipment; Bentonite drilling mud: product information, material specifications, handling procedures, MSDS (material safety data sheet), special precautions required, and method of mixing and application; Pipe and Fittings: material specifications, pipe fusion equipment, specifications, operation procedures, and testing requirements.

C. Site Conditions: The operations must be conducted in a manner to eliminate discharge of water, drilling mud, and cuttings to streams and other water bodies.

D. General: The directional boring scope shall include, but not be limited to, steerable directional boring equipment, boring pits and equipment, sheeting, location signs as required, miscellaneous appurtenances to complete the entire work as shown on the plan and drawings, and restoration. Directional boring operations shall be performed within the right of way and/or easements shown on the drawings.

Determine the drilling length and equipment pull strength for the type of soil encountered. Provide method to control line and grade.

1. Provide and maintain instrumentation that will accurately locate the pilot hole.
2. Drill pilot hole along the path shown on drawings to the following tolerances:
    a. Vertical alignment plus or minus one (1) foot. Vertical path of the pilot hole must not establish new high points not shown on the profile drawings.
    b. Horizontal alignment plus or minus one (1) foot along pipe corridor.
3. Record position readings at a maximum of ten-foot intervals.
4. At completion of pilot hole drilling, provide Engineer with tabulations of horizontal and vertical alignment. Serious deviations between the design position which may affect the installation of the pipeline which are beyond the control of the Contractor to correct shall be documented and immediately brought to the attention of the Owner for discussion and/or approval. The profile and alignment designed on the construction drawings for the bores define the minimum depth.

E. Drilling Fluids: Maintain drilling fluid in bore hole to increase stability of the surrounding soil and reduce drag on pulled pipe. Dispose of drilling fluid and other spoils at location chosen by Contractor and approved by Engineer and Owner. Transport excess fluids and other spoils to a disposal site. Disposal shall be performed at no cost to the Owner. Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterways. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials should be hauled away

to a suitable, legal disposal site. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

F. Pilot Hole Drilling: Establish entry angle hole so that the curvature of the pilot hole does not exceed the allowable bending radius of the HDPE pipe. Maintain a curvature so that it does not exceed the allowable bending radius of HDPE pipe.

Follow the pipeline alignment, as shown on the drawings, within the tolerances specified herein. Prior to adjustments, notify Engineer for approval. Notify Engineer when forward motion of operation is stopped by an obstruction. When it is determined impossible to advance the HDD, abandon in place filled with drilling fluid, unless otherwise directed by the Engineer. Attemp a second installation at a location approved by the Engineer. Withdrawls, abandonments, and restarts are at no additional expense to the Owner. If pilot hole, or exit point fails to conform to drawing or is outside of easement limits, too deep, or too shallow, the Owner may require a new pilot hole.

Exercise caution including, but not limited to, the following steps: locate all utilities. Provide down holes (test pits) to observe drill stems or reamer assembly clearing any utility or structure as necessary. Test pits shall be performed at no additional cost to the Owner.

G. Installing HDPE Pipe: Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on the pull section after drilling pilot hole. Hold reaming diameter to 1.5 times the outside diameter of HDPE pipe being installed. Protect pull section as it proceeds during pull back so that it moves freely and is not damaged by stones or debris on the ground. When connecting to the adjacent pipe section or struction, allow the pulled section of pipe to extend past the termination point. Make tie-ins in a minimum of 24 hours after the pullback of HDPE pipe. The necessary amount of extra pulled HDPE pipe will be at the Contractor's discretion. Contractor to provide restrained joint on the backside of the transition coupling from HDPE to the adjacent pipe section.

H. Testing: Pipe installed is required to be an integral part of the overall system. The pipe shall be tested in accordance with the Plastic Pipe Institute document entitled "Inspections, Test and Safety Considerations." Hydrostatic pressure testing will be done utilizing water as the test medium and following the document sections on "Hydrostatic Pressure Testing of Water Mains." Contractor shall provide one copy of Record Drawings with x-y-z coordinates prior to final acceptance of installation. The pipe shall be sterilized in accordance with these specifications.

3.4 INSTALLATION OF PIPE, FITTINGS, AND ACCESSORIES

A. Handling: Pipe shall be placed in trench in such a manner as to prevent damage to pipe and protective coatings and linings. Under no circumstances shall pipe be dropped or dumped into trench.

B. Cleaning: Every precaution shall be taken to prevent foreign material from entering pipe while it is being installed. Spigot and bell ends of pipe and gaskets shall be cleaned and lubricated

according to the manufacturer's instructions. When pipe laying is not in progress, open ends of pipe shall be closed by a watertight plug.

C. Direction of Laying: Pipe shall be laid with bell ends facing in direction of laying, unless otherwise directed by Engineer. Laying shall start at bottom and shall proceed upward with bell ends of pipe upgrade, where feasible.

D. Roadway Crossings Through Casings: When special conditions require use of casings, spiders shall be bolted to pipe before it is pushed into casing, to keep it centered and avoid damage during installation. Care shall be taken to insure that installed pipeline is well secured to prevent movement, as shown in Details.

E. Stream Crossings: When water mains cross under streams, ductile iron pipe and concrete encasement shall be used. Concrete encasement shall extend a minimum of five (5) feet to each side of the stream crossing or until the pipe construction is out of the water table, whichever is further. Minimum cover along the stream crossing shall be 24-inches measured from the top of encasement and as shown in the standard details.

F. Deflection at Joints: Maximum deflection for joints will be as follows:

Maximum Allowable Deflection in Inches

Pipe Size	Ductile Iron (Mechanical) Lengths				Ductile Iron (Push On) Lengths				PVC SDR 14
	12'	16'	18'	20'	12'	16'	18'	20'	20'
4"	21	28	31	34	12	17	19	21	12
6"	18	24	27	30	12	17	19	21	4
8"	13	18	20	22	12	17	19	21	3
10"	13	18	20	22	12	17	19	21	2.5
12"	13	18	20	22	12	17	19	21	2
16"	9	12	13.5	15	7.5	10	11	12	--

G. Setting of Valves, Hydrants, and Fittings: Provide a valve box for every valve. Valve box shall not transmit shock or stress to valve and shall be centered and plumb over wrench nut of valve, with box cover flush with surface of finished pavement or as directed by Engineer. Valve boxes shall be installed in accordance with plan details. Hydrants shall be set so that center of outlet is 16 to 18 inches above finished grade when connected to main and shall be tied to main or anchored to control thrust. At least 0.5 cubic yards of crushed stone or gravel shall be provided under base to allow drainage from hydrant drain valve. Hydrants shall not be subject to surface flooding and shall be installed per plan details. Extra supports are required for fittings, valves, and hydrants when PVC pipe is used. Only valves, valve boxes, and hydrants approved by the Engineer may be used during system construction.

H. Anchorage: Pipe lines shall be protected against joint pulling or thrust damage by suitable anchors, braces, or tie rods installed at direction changes as a result of fittings and all other critical points. Rods and clamps shall be galvanized or otherwise rustproof treated. Reaction

backing shall be of size indicated on plans and in the plan details and shall bear on solid undisturbed earth. Where Mega Lug, AquaGrip, Lok-Tyton, Super-Lock or a similar joint or mega lug restraining gland is used, bracing and anchorage will not be required.

H. Hydrostatic Pressure Testing of Water Mains:

1. Hydrostatic testing shall be performed in accordance with this specification and in presence of Owner representative. Where this specification cites that work shall be "approved" or "acceptable", it shall be understood that such approval or acceptance shall be by Owner.
2. All construction, including piping, valves, equipment, thrust restraints, and sufficient backfill to prevent pipe movement, shall be complete, inspected, and approved before testing is performed. Testing shall be performed within 30 days after completion of pipe installation, but at least 7 days after final concrete thrust anchor has been poured.
3. Hydrostatic pressure testing shall be performed against closed fire hydrants, if present; after installation of service taps, if applicable; and with closed air release valves.
4. Flushing of water lines shall be performed in such a manner as to prevent erosion control nuisance, interruption of traffic, or damage to downstream properties.
5. Section of pipe to be tested shall be isolated from connecting sections in an acceptable manner and slowly filled with potable water. When existing water mains are used as water source, acceptable backflow prevention measures shall be utilized, which measures shall be removed before testing begins. All air shall be expelled from pipe before testing is performed. Prevent entrapment of air at high points.
6. Test equipment shall be supplied by the Contractor, properly calibrated and approved before use, and shall maintain a stable test pressure, ± 5 psi, for duration of test. Test pressure shall be 1.5 times anticipated working pressure of water main, based on highest static pressure within project limits, as determined by Engineer, but not less than 150 psi, nor higher than 250 psi, or as shown on the plans.
7. Duration of test shall be a minimum of two hours. During this time, all pipe, joints, fittings, and equipment shall be observed for apparent leakage.
8. Leakage shall be defined as observed water loss at any point within section of pipe being tested, or as quantity of water that must be supplied to maintain test pressure, ± 5 psi. Leakage shall not be measured by a drop in pressure over time.
9. Allowable leakage, in gallons per hour, per 1,000 feet of ductile iron pipe.

Avg. Test Pressure (psi)	**Nominal Pipe Diameter, in.**								
	4	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
250	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37
225	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25
200	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12

175	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98
150	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84

10. Allowable leakage, in gallons per hour, per 50 joints of polyvinyl chloride (PVC) pipe.

Avg. Test Pressure	**Nominal Pipe Diameter, in.**								
(psi)	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**
250	0.23	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92
225	0.22	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82
200	0.20	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72
175	0.19	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61
150	0.17	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49

11. All defective materials and workmanship shall be repaired. Also, measured leakage that exceeds limits specified in the tables in Section 33 shall be cause for Contractor to investigate and correct leaks, in accordance with Contract Documents.
12. Upon completion of corrective measures, the pressure test shall be repeated.
13. This procedure shall be repeated until leakage is within limits cited above. Acceptance shall be based on allowable leakage.
14. Cost of all testing and repairs shall be responsibility of the Contractor, as part of Project. Additional cost to Owner for engineering and/or inspection services for re-testing shall be responsibility of the Contractor and shall be deducted from contract proceeds.
15. Volume of water required to initially fill new lines for pressure testing will be provided by Owner. If pressure testing fails and leaks are found, any additional water required to refill lines after initial test will need to be purchased by Contractor from Owner.

3.5 DISINFECTION OF WATER MAINS

A. Water mains and accessories shall be disinfected in accordance with AWWA C651. Care shall be taken to minimize entrance of foreign material into pipe, fittings, and valves. The water main shall be flushed prior to disinfection, with sufficient flow to produce a velocity of 2.5 fps. Flushing shall take place in areas with adequate drainage.

Diameter (in.)	**GPM @ 2.5 ft/sec**
6	220
8	392
10	612
12	881
16	1565

B. Chlorine application by approved method shall be made using water from existing distribution system or water supply. Initial chlorine concentration in water to be used shall be a minimum of 50 mg/L free available chlorine. Chlorinated water shall be retained in water main for at

least 24 hours, but not more than 72 hours, during which time all valves and hydrants in section treated shall be operated. At end of this period, treated water shall contain no less than 25 mg/L free available chlorine throughout, and final flushing shall follow to insure that chlorine concentration is not higher than that generally prevailing in system, before being used by any customer. Chlorinated water shall not be discharged to any water course or drainageway until it is diluted or reduced to a level which will result in no damage to aquatic life. A dechlorination device detail shall be submitted to the Engineer for approval prior to use.

C. After final flushing and before water main is placed in service, two consecutive samples shall be collected at 24 hours intervals for each 2,000 feet of line. These samples shall be tested for bacteriologic quality by a laboratory approved by Virginia Division of Consolidated Laboratories and shall show absence of coliform organisms. Samples will be collected by Contractor. At its discretion, the Owner may require that it collect all samples. If initial disinfection fails to produce satisfactory results, water line shall be flushed and disinfection shall be repeated until satisfactory samples have been obtained. Costs associated with flushing, disinfection, and laboratory testing, including repeat applications of the procedures after failure of testing, will be at Contractor's expense. Initial water required for flushing will be provided by Owner at no cost to Contractor.

D. Methods of Application:

1. Continuous feed method - Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the main at least 24 hours, after which, the chlorine concentration in the water shall be at least 25 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the main.

2. Slug method - Potable water shall be introduced into the main at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the main are exposed to the 100 mg/L chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2,000 feet to insure that adequate residual is maintained. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

3.6 BACTERIOLOGIC TESTS

A. After final flushing, and before water main is placed in service, a sample or samples shall be collected from end of water line and tested for bacteriologic quality and shall show absence of coliform organisms. At least one set of samples shall be collected at least 24 hours apart, in every 1,200’ section of new water main, plus one set from the end of the line and at least one set from each branch, and tested by a Virginia Division of Consolidated Laboratories. The approved laboratory and results shall be submitted to the Engineer. Test failure shall be followed by repeating disinfection procedure in Section 3.4 of this specification and repeat sampling and testing, until test success. Contractor shall be responsible for collecting all bacteriological samples and having laboratory tests made to determine presence of total

coliform bacteria. All costs associated with bacteriologic testing, including re-testing due to test failure, shall be the responsibility of the Contractor.

B. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulphate. If laboratory results indicate presence of total coliform bacteria, samples are unsatisfactory and disinfection shall be repeated until samples are satisfactory. The tablet method shall not be used in repeated disinfections. Cleaning and disinfection will be responsibility of Contractor. Water for these operations will be furnished by Owner, but Contractor shall be responsible for loading, hauling and discharging of water.

C. If a corporation stop or other sampling means is not available at required minimum intervals along water line, Contractor shall install, at his own expense, a sampling tap consisting of a corporation cock installed in pipe with a copper goose neck assembly.

D. Testing and disinfection of completed sections shall not relieve Contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at Contractor's expense.

3.7 BACKFILLING

Refer to Division 31 Section – Earth Moving.

3.8 CLEANUP

A. Contractor shall at all times keep job site clean to satisfaction of Engineer. Surfaces of paved streets shall be "broomed" immediately after backfilling. Surplus materials shall be removed and disposed of from site of work, unless directed otherwise by Engineer. Where material is placed on pavement, a layer of stone dust or sand shall be applied first to facilitate cleanup.

3.9 SEEDING

A. Refer to Division 32 Section – Lawns & Grasses

END OF SECTION 331113

SECTION 331250 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included: Provide complete, in place, and free from leakage, all valves as shown on the plans and in accordance with this Specification. Valves shall be furnished complete with valve operators and accessories for a complete assembly adequate for the specified or indicated purpose. Valve assemblies shall be installed, painted, tested, and adjusted.

B. Related Sections:
   1. Section 330500 – Common Work Results for Utilities
   2. Section 331113 – Public Water Utility Distribution Piping

1.3 REFERENCES

A. General: The work shall comply with the most recent standards or tentative standards as published at the date of the contract and as listed in this specification using the abbreviation shown.
   1. American National Standard Institute (ANSI):
      a. Z21.22 – Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
   2. American National Standard Institute (ANSI)/American Society of Sanitary Engineers (ASSE):
      a. 1011 – Hose Connection Vacuum Breakers
      b. 1013 – Reduced Pressure Principle Backflow Preventers
   3. American National Standard Institute (ANSI)/American Water Works Association (AWWA):
      a. C500 – Standard for Metal Seated Gate Valves for Water Supply Service
      b. C508 – Standard for Swing-Check Valves for Waterworks Service
      c. C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service
      d. C800 – Standard for Underground Service Line Valves and Fittings
   4. American Society for Testing and Material (ASTM):
      a. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   5. National Sanitation Foundation (NSF):
      a. 61 – Standard which states certified NSF products are limited 11 parts per billion (PPB) of lead in water from endpoint devices.

1.4 SUBMITTALS

A. General: Submittals shall be in accordance with Section 013300 – Submittals. Each submittal shall be identified with precise use, line, and location.

B. Shop Drawings: As a minimum, shop plans shall include manufacturer's name, class of materials, catalog, and engineering data showing compliance with the specified requirements.

C. Maintenance Instructions: Submit corrective and preventive maintenance instructions, including recommended spare parts.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of valve and specialties and are based on the specific system indicated.

B. Valves shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. Comply with NSF 61 for materials for piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL

A. Valves: All valves shall be certified by the National Sanitation Foundation for potable water service (NSF 61) and the same shall be so indicated on the valve.

2.2 PRESSURE RELIEF VALVES

A. The pressure relief valves shall be equal to Cla-Val 50-01 Pressure Relief & Pressure Sustaining Valve as manufactured by Cla-Val Co., Newport Beach, CA 92659-0325, or approved equal. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three (3) years from date of shipment. A direct factory representative shall be made available for start-up service, inspection, O&M training, and necessary adjustment.

The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is normally held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked. The Contractor shall connect the sensing/pilot supply connection to the main header with minimum ¾" pipe or tubing.

A full range of spring settings shall be available in ranges from 0 – 300 psi.

B. The valve manufacturer shall provide a repair kit for the main valve and both pilots as part of the submittal for each valve supplied.

2.3 GATE VALVES

A. Valves shall be either cast iron or ductile iron body, resilient seated with reinforced rubber seat
ring or permanently bonded disc, and machined seating surface, brass or bronze non-rising stems, and complying with AWWA C.509 or C.515. Body shall be self centering or shall have guides for alignment of wedge disc and have internal epoxy coating approved for potable water. Working pressure shall be at least 250 psi and hydrostatically tested to 500 psi for valves

16 inches in diameter and smaller. Valves shall have O-ring seals and open left (counter-clockwise) with a 2-inch square wrench nut. Valve ends shall be of mechanical joint type with all bolts, glands, and rubber gaskets furnished in the price of the valve. Valves shall be Mueller A-2360- 20, Kennedy C509, or equal approved by Engineer.

B. All exposed valves are to be operated by a handwheel.

C. Valves located on bypass lines within meter vaults are to have locking mechanisms installed to prevent operation by unauthorized personnel.

2.4 AIR RELEASE VALVES

A. Automatic air release valves shall automatically function to release to the atmosphere small amounts of entrained air, which may accumulate in the pipeline. Once the accumulated air is exhausted, valves shall seat tightly to prevent water leakage. Air release valves shall be 1" for pipe sizes 12" and smaller; valves shall be 2" for pipe sizes larger than 12". Such valves shall have a working pressure of not less than 250 psi or greater and shall be capable of venting 26 cubic feet per minute at 150 psi. Valves shall be installed in a vault according to the Standard Detail AR-1. Air release valves shall be as manufactured by Cla-Val, Valmatic, Crispin, Bermad, or approved equal.

2.5 SAMPLING TAPS/VALVES

A. The sampling tap shall be plain end spigot faucet, renewable seats, tee handles, polished chrome plated similar to American Standard 4221.024.

2.6 BALL VALVES

A. Ball valves shall be equal to Speedaire industrial quality, two piece forged brass ball valves. The valves shall be minimum 200 p.s.i. rated with reinforced PTFE seats, chrome plated ball for long life, separate pack nut to permit handle removal under pressure and bottom loaded stem for safety. Corrosion resistance steel handle shall be provided with a vinyl grip and 1/4" twin stop for positive control. The valve must meet Federal Spec. WW-V-35.

2.7 PRESSURE REDUCING VALVES

A. The pressure reducing valves shall be equal to Cla-Val 90-01 Pressure Reducing Valve as manufactured by Cla-Val Co., Newport Beach, CA 92659-0325, or approved equal. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three (3) years from date of shipment. A direct factory representative shall be made available for start-up service, inspection, O&M training, and necessary adjustment.

The pressure reducing valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure. The pressure reducing pilot shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm control designed to permit flow when

controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm, and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. Nor variable orifices shall be permitted. The pilot system shall include an opening speed control on all valves 3" and smaller as standard equipment. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

A full range of spring settings shall be available in ranges from 0 – 300 psi. All pressure reducing valves are to have check valve and strainer options included.

B. The valve manufacturer shall provide a repair kit for the main valve and pilot system as part of the submittal for each valve supplied.

2.8 ALTITUDE VALVES

A. General: One-way altitude valves shall function to control the level in a tank without the use of floats or probes in the tank itself. It shall be a one-way flow (single-acting) type, designed to open fully to fill the tank and close completely when the predetermined high level is reached. Sensing of the altitude pilot shall be by means of a field-installed sense line between the pilot and base of the tank. The altitude valve shall be equipped with an indicator assembly. The altitude valve will close when the preset high level has been reached. The valve will remain closed until the level in the tank has dropped to a preset level, at which point the altitude valve will open. The one-way altitude valve shall be sized according to the design plans.

B. Main Valve: The one-way altitude valve shall be a single-seated, line pressure operated, diaphragm actuated, pilot controlled globe valve. The valve shall seal by means of a corrosion-resistant seat and a resilient, rectangular seat disc. These, and other parts, shall be replaceable without removing the valve from the line. The stem of the main valve shall be guided top and bottom by integral bushings. Alignment of the body, bonnet and diaphragm assembly shall be by precision dowel pins. The diaphragm shall not be used as a seating surface, nor shall the pistons be used as an operating means. The pilot system shall be furnished complete and installed on the main valve. It shall include the altitude pilot, a needle valve, Y-strainer and isolation ball valves. The one-way altitude valve shall be operationally and hydrostatically tested prior to shipment.

C. Materials: The main valve body and bonnet shall be ductile iron per ASTM A536, Grade 65-45-12. End connections shall be ANSI B16.42 Class 300# flange. All ferrous surfaces shall be coated with a minimum of 4 mils of an NSF-61 approved epoxy. The main valve ring shall be bronze per ASTM B61. Elastomers (diaphragms, resilient seats and O-rings) shall be Buna-N. The pilot shall be bronze per ASTM B61. The needle valve and isolation ball valves shall be brass and control line tubing shall be copper.

D. Operating Conditions: One-way altitude valve shall be suitable for a flow of 2,800 gpm, a maximum pressure of 250 psi, and a full tank level of 50 feet.

2.9 PRESSURE MANAGEMENT CONTROL VALVES

A. The pressure management valves shall be equal to Cla-Val 98-06 Hydraulic Pressure Management Control Valve With Hydraulically Dampened Switching Between Dual Set Points as manufactured by Cla-Val Co., Newport Beach, CA 92659-0325, or approved equal. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three (3) years from date of shipment. A direct factory representative shall be made available for start-up service, inspection, O&M training, and necessary adjustment.

The pressure management control valve shall be capable of controlling downstream pressure to a low pressure set point or high pressure set point with varying flow rate. As flow increase from a low flow condition to a high flow condition, the regulated outlet pressure shall increase from the low set point pressure to the high set point pressure. The low set point pressure, high set point pressure, and flow (based on valve position) at which pressure increases to the high set point pressure shall be adjustable. The rate of change between the two set points shall be hydraulically damped to gradually increase or decrease pressure to prevent downstream piping system surges.

The valve shall not have an orifice plate or other restriction in the main line as part of the valve control. It shall operate only under hydraulic control without electrical or electronic (powered or battery operated) controls. It shall control downstream pressure to either the low pressure set point or high pressure set point depending on whether the flow is below or above the adjustable switch point.

The pilot system adjustments shall only require simple tools to make changes and allow for changes to be made to the flow switch point without resizing an orifice plate, readjusting a restriction in the line, or reprogramming electronic control. The dual outlet pressure reducing pilot control shall be a direct-acting adjustable, spring loaded, normally open, diaphragm valve designed to permit flow at predetermined pressure set points when controlled pressure is less than the spring setting. The pilot control system shall include separate adjustments for setting the high pressure, low pressure, and flow rate at which pressure increases or decreases between set points. It shall have an integral bias chamber which allows switching between the low and high pressure set points. External bias chambers, either above or below the pilot, shall not be allowed. The pilot control system shall incorporate a stem valve that either blocks or allows upstream pressure into the pressure reducing pilot control bias chamber for switching between high and low set point pressures. The switching between low and high set point pressures shall be hydraulically dampened to prevent downstream pressure surges. Two separate pilot controls with no dampening shall not be allowed. The pressure reducing control shall have an adjustable low pressure setting up to 30 psi below the high pressure set point.

B. The valve manufacturer shall provide a repair kit for the main valve and pilot system as part of the submittal for each valve supplied.

2.10 COMBINATION PRESSURE REDUCING & PRESSURE SUSTAINING VALVES

A. The pressure reducing/pressure sustaining valves shall be equal to Cla-Val 92-01 Combination Pressure Reducing & Pressure Sustaining Valve as manufactured by Cla-Val Co., Newport Beach, CA 92659-0325, or approved equal. The valve manufacturer shall warrant the valve to

be free of defects in material and workmanship for a period of three (3) years from date of shipment. A direct factory representative shall be made available for start-up service, inspection, O&M training, and necessary adjustment.

The combination valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure. When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain a constant inlet pressure.

The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include an opening speed control as standard equipment. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

The pressure sustaining pilot control shall be a direct-acting adjustable spring loaded control which opens when upstream pressure exceeds the spring setting on the pilot. The pilot control system shall include an X44A strainer & orifice assembly.

A full range of spring settings shall be available in ranges of 0 – 300 psi. All valves are to have a check valve option included.

B. The valve manufacturer shall provide a repair kit for the main valve and pilot system as part of the submittal for each valve supplied.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Valves shall be cleaned to remove all dirt or other foreign material. Valve installation shall comply with project details and the manufacturer's recommendations.

B. Valves: Before installation, clean valves to remove all dirt or other foreign materials.

C. Stems: Shall be oriented for accessibility as approved by the Engineer. Do not install valves with stems in the downward direction.

D. Setting of Valves: A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the valve, with the cover flush with the surface of the finished grade or as directed by the Engineer.

E. Transmitting Forces: Valves and valve boxes shall be installed so no forces are transmitted to the valve through the piping or valve boxes.

F. Flushing: All valves and appurtenances shall be flushed clear of all foreign material after installation.

G. Calibration: Contractor shall furnish the services of factory authorized service engineer to instruct and check out the calibration of all control valves.

H. Testing: Field test all valves and appurtenances for proper operation, proper adjustments and settings, freedom from vibration, binding, scrapings, and other defects. Check all valve supports for strength and high quality workmanship. All defects shall be corrected to the satisfaction of the Owner. Hydrostatic and leakage tests shall be in accordance with Section 331113 – Utility Distribution Piping.
   1. The Contractor shall arrange for the equipment manufacturer to furnish the services of a qualified field service representative for testing.
   2. For each valve, the representative shall inspect the installation and supervise startup, field testing, and initial operation of not less than one day and instruct the Owner in proper operation, maintenance, and repair procedures for not less than one day.

END OF SECTION 331250

SECTION 331415 - SITE WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. DIP: Ductile Iron

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

2.2 GATE VALVES

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

2.3 WATER METERS AND WATER METER BOXES

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Provide Product indicated on Drawings or approved equal.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: As indicated on Drawings.

B. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.

a. Standard: ASSE 1060.
b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

1) Housing: Reinforced aluminum or fiberglass construction.

a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
b) Drain opening for units with drain connection.
c) Access doors with locking devices.
d) Insulation inside housing.

e) Anchoring devices for attaching housing to concrete base.

2) Electric heating cable or heater with self-limiting temperature control.

B. Enclosure Bases:

1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.6 FIRE HYDRANTS

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.3 ANCHORAGE INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.4 VALVE INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.5 WATER METER AND WATER METER BOX INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.6 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.7 CONCRETE VAULT INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.8 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.9 FIRE HYDRANT INSTALLATION

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

3.11 CONNECTIONS

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

3.12 FIELD QUALITY CONTROL

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

B. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331415

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Pressure pipe couplings.
4. Expansion joints and deflection fittings.
5. Backwater valves.
6. Cleanouts.
7. Drains.
8. Encasement for piping.
9. Manholes.
10. Channel drainage systems.
11. Catch basins.
12. Stormwater inlets.
13. Stormwater detention structures.
14. Pipe outlets.
15. Dry wells.
16. Stormwater disposal systems.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer no fewer than 48 hours in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.3 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35 PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, [**SDR 35**] <**Insert SDR**>, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
2. Class III

2.5 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. NDS Inc.
f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
g. Or equal

2. Description: Elastomeric sleeve with stainless-steel shear ring corrosion-resistant-metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

A. Plastic Cleanouts:

1. Manufacturers:

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.
g. Or equal

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, 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 written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
3. Install PE corrugated sewer piping according to ASTM D 2321.
4. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

3.4 CONNECTIONS

A. Make connections to existing piping and underground manholes.

B. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate

3.5 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape.

3.6 FIELD QUALITY CONTROL

A. 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 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 visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: 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.

3.7 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100

SECTION 334200 – CULVERTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.
3. Drains.
4. Manholes.
5. Stormwater inlets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Stormwater inlets: Include plans, elevations, sections, details, frames, covers, and grates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Pipe and fittings as indicated on the plans and in accordance with VDOT Road and Bridge Specification Section 232.

2.2 CLEANOUTS

A. In accordance with The City of Staunton - Manual of Specifications and Standard Details, current edition.

2.3 MANHOLES

A. Use Standard Virginia Department of Transportation (VDOT) manhole as specified on plans.

2.4 STORMWATER INLETS

A. Use Standard Virginia Department of Transportation (VDOT) inlet type and size as specified on plans.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, 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 written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping and jointing according to VDOT Road and Bridge Specification Sections 302 and 303.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block as indicated on the plans. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.4 MANHOLE AND STORMWATER INLET INSTALLATION

A. In accordance with VDOT Road and Bridge Specification Sections 302 and 303.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.7 FIELD QUALITY CONTROL

A. 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 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 visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: 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.

B. 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 requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with water.

END OF SECTION 334200