

PROJECT MANUAL

NEW CONSTRUCTION FOR

BEDFORD COUNTY DEPARTMENT OF SOCIAL SERVICES

FALLING CREEK ROAD | BEDFORD VA 24523

SPECTRUM DESIGN PROJECT NO.:
24112



SPECTRUM DESIGN
architects | engineers

PROJECT PHASE:
BID DOCUMENTS

DATE:
06.12.2026

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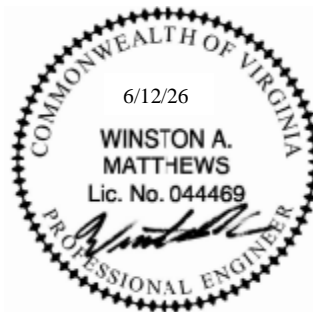
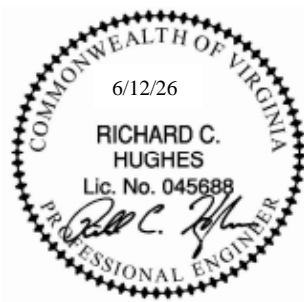
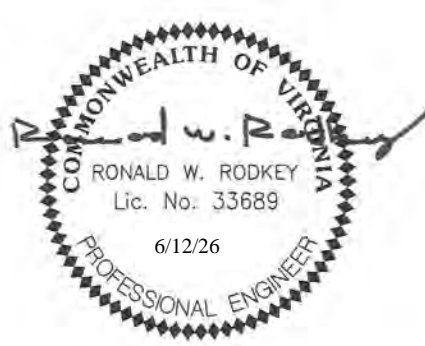
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DOCUMENT 001050
INVITATION FOR BID

Bedford County will receive sealed bids for the Bedford County Department of Social Services located at Falling Creek Road, Bedford, VA 24523, Tax Map Tax Map # 147-A-40.

DESCRIPTION OF WORK: Construct a new 37,290 SF office building for the Department of Social Services housing office and training/assembly spaces and other Work indicated in the Contract Documents.

Bids shall be prepared on a single-prime, lump sum basis. Bids will be received until **3:00 PM local time on July 31, 2026**. Bids may be delivered by hard copy or electronically. Hard copies shall be delivered to Finance Department, 122 East Main Street, Suite 203, Bedford VA 24523. Electronic deliveries shall be emailed to hknight@bedfordcountyva.gov. Bids will be opened and read aloud 15 minutes following in the 3rd Floor Large Meeting Room.

Bidders and other interested parties may obtain drawings and specifications containing the information necessary for bidding at TRASCO Plan Room, eVA.virginia.gov and the Bedford County website.

A Pre-Bid Meeting will be held at the Bedford County Gym, 1059 Turning Point Rd, Bedford, VA 24523 on July 9, 2026, at 10:00 AM. A site visit will immediately follow. Questions should be submitted in writing to hknight@bedfordcountyva.gov on the Pre-Bid Question form included in the project manual until 3:00 PM local time on July, 17, 2026.

BID SECURITY: Each Contractor must submit, with the Bid Documents, a bid security in the amount of five (5) percent of the bid as described in the Instructions of Bidders. The successful Contractors will be required to furnish and pay for performance and payment bonds from a bonding company licensed in the Commonwealth of Virginia as described in the Instructions to Bidders.

The attention of each Bidder is directed to Title 54.1 of Chapter 11, Code of Virginia, pertaining to registration.

All Bids shall remain valid for a period of thirty (30) days after the scheduled bid due date. Withdrawal of bids due to error shall be in accordance with Section 2.2-4330, Code of Virginia.

The Owner reserves the right to reject any or all Bids, to waive informalities or irregularities in the bids received, to accept the Bid deemed to be in the best interest of the Owner, and to negotiate with the apparent low bidder should the lowest responsive and responsible bid exceed the funds available for the project.

For additional information contact:

Owner

Heather Knight

Bedford County

Email: HKnight@bedfordcountyva.gov

END OF INVITATION FOR BID

DOCUMENT 001200
INSTRUCTIONS TO BIDDERS – AIA

1.1 SUMMARY

- A. Document Includes:
 - 1. Instructions to Bidders A701.
- B. Related Documents:
 - 1. Document 00 70 10 – General Conditions – AIA.
 - 2. Document 00 81 10 – Supplementary General Conditions.

1.2 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701-1997, Instructions to Bidders shall be used in submitting bids on this project.

1.3 SUPPLEMENTARY CONDITIONS

- A. Refer to Document 00 20 10 for Supplementary Instructions to Bidders.

END OF INSTRUCTIONS TO BIDDERS - AIA

DOCUMENT 002010
SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.1 SUMMARY

- A. Document Includes:
 - 1. Instructions to Bidders.
 - 2. Examination.
 - 3. Prebid conference.
- B. Related Documents:
 - 1. Document 00 10 50 – Invitation for Bid.
 - 2. Document 00 30 00 – Information Available To Bidders.
 - 3. Document 00 41 10 – Bid Form – Stipulated Price.
 - 4. Document 00 70 10 – General Conditions.
 - 5. Document 00 81 10 – Supplementary General Conditions.

1.2 INSTRUCTIONS TO BIDDERS

- A. These Instructions to Bidders amend or supplement AIA Document A701-1997 - Instructions to Bidders and other provisions of Bidding Documents and Contract Documents. Where any Article of the Instructions is modified or a Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Instructions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 1 – BIDDERS REPRESENTATIONS

Add Paragraph:

- 2.1.5 Data in the bidding documents pertaining to existing conditions is for convenience only and does not supplant obtaining first-hand information at the site.

ARTICLE 3 – BIDDING DOCUMENTS

Add Paragraph:

- 3.1.5 Bidders shall thoroughly examine and be familiar with the Contract Documents. The failure or omission of any bidder to receive or examine any form, instrument, bulletin, addendum, or other documents, or to visit the site and acquaint himself with conditions there existing shall in no way relieve any bidder from any obligation with respect to his Bid or to the Contract. The submission of a Bid shall be taken as prima facie evidence of compliance with this section.
- 3.2.4 The Work of this project shall be performed in accordance with the Contract Documents; however, the plans and specifications are intended to complement and supplement each other and any work required by either and not by the other shall be performed as if denoted in both. Should a bidder find discrepancies in, or omissions from the plans or the specifications, or be in doubt as to their

meaning, he shall at once notify the Architect. Failure to request such interpretations shall in no way relieve the Contractor of his responsibility for executing the project properly and completely. Unless otherwise clarified by the Architect, bidders shall base their bids on the highest quality of material or techniques required by any part of the Contract Documents.

Delete Subparagraph 3.3.2 and replace with the following:

- 3.3.2 No substitutions shall be approved prior to the time and date designated for the receipt of Bids.

ARTICLE 4 – BIDDING PROCEDURES

Add Paragraph:

- 4.1.8 Original and one copy of each shall be submitted. Both copies shall have original signatures.
- 4.1.9 Particular attention is called to Article 4.3.7 of the General Conditions (including information in Section 00811 SUPPLEMENTARY CONDITIONS – AIA) regarding requirements of the contractor to account for reasonable weather conditions.

Modify Paragraph:

- 4.2.1 Add the following text: “If the amount of bid guarantee exceeds the difference between its related bid and the next lowest bid resulting in a contract, the Owner shall retain only an amount equal to the difference between these two bids plus expenses by Owner’s Architect related to negotiating contract with other bidder.”

Add Paragraph:

- 4.2.4 Each Bid must be accompanied by a Bid Guarantee of five percent (5%) of the largest amount for which proposal is being made, and at the option of the bidder, may be cash, a certified check or bid bond made payable to the party listed in the Invitation for Bids. All bonds shall be written by sureties or insurance companies licensed to do business in the Commonwealth of Virginia. Other bid bond forms will be acceptable if they are the same in both form as well as substance as AIA Document A310, Bid Bond.

Modify Paragraph:

- 4.3.1 Add the following text: “Sealed envelope shall also be clearly marked with date and time of bid opening so as to guard against premature opening of any bid. No responsibility shall be attached to the Architect and the Owner for premature opening of bids not properly addressed or identified.

Add Paragraphs:

4.3.5 The attention of the Bidder is directed to Title 54.1, Chapter 11, Code of Virginia, as amended, which requires evidence of a Class A certificate of registration before a Bid may be received and considered (1) on a general or subcontract of \$120,000 or more; or (2) if the total value of all contracts undertaken by the bidder during any 12-month period is \$750,000 or more.

4.3.6 In compliance with the above requirements, each bidder shall place on the outside of the envelope containing his bid and over his signature one of the following notations:

"Registered Class A Virginia Contractor, No. _____.
or
"Class A Registration not required."

4.3.7 It shall be the Bidder's responsibility to check all sub-bids carefully to determine whether or not any exceptions, omissions, or alterations to the Drawings and Specifications have been noted therein; bidder is solely responsible for a complete job in strict accordance with Bidding Documents.

4.4.5 The withdrawal of Bids shall be in accordance with Section 2.2-4330, Code of Virginia, 1950, as amended.

ARTICLE 5 – CONSIDERATION OF BIDS

Modify Paragraph:

5.1 Change last sentence to read: "An abstract of the Bids may be made available to Bidders, except in the event that the public body decides not to accept any of the Bids and to rebid the Contract. If the Contract is rebid, Bid records shall be open to public inspection only after award of the Contract."

Add Paragraphs:

5.1.1. The officer or agent of the Owner, whose duty it is to open the Bids, will decide when the specified time for receipt of bids has arrived and no bids received thereafter will be considered. No responsibility will be attached to any officer, agent or representative for the premature opening of a Bid not properly addressed and identified. It is the responsibility of the bidder to assure that his Bid is delivered to the designated place for opening prior to the time set for opening Bids.

1. Only one Bid package may be submitted by any one Bidder. If more than one Bid is offered by one Bidder, all such Bids will be rejected. A Sub-bidder who has quoted prices to a Bidder is not thereby disqualified from quoting prices to other Bidders or from submitting a Bid on his own behalf.
2. The Owner will evaluate the quality, timeliness, and reliability of any contract work performed by the Bidder for the Owner within the previous five (5) years. This evaluation shall be a prime determinant in judging the ability of the Bidder to perform the prescribed work.

- 5.1.2 At the opening of Bids, should questions arise regarding the validity of any Bid because of errors, omissions, waiver of informalities or other points or provisions in submitted proposals, no comment or decision will be made until a ruling has been obtained from the Owner's legal representative.

Delete Paragraph 5.3.1 and replace with the following:

- 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 and does not exceed the funds available. In determining the lowest responsive Bidder, the Owner may consider, among other factors, the Bidder's performance on other contracts and information provided by the Bidder on AIA Document A305, Contractor's Qualification Statement, in the event such Statement is required. The Owner shall have the right to waive informalities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

Add Paragraphs:

- 5.3.3 In case of a tie Bid, preference shall be given to goods, services, and construction produced in or around the locality of the project site, or provided by persons, firms or corporations having principal places of business near the project site, if such a choice is available; otherwise the tie shall be decided by lot. The business closer to the project site shall be given preference over a business farther away from the project site, in the event of a tie Bid, if such a choice is available.
- 5.3.4 If all Bids received exceed the available funding for the Work, the Owner may meet with the lowest responsive and responsible Bidder to discuss a reduction in the scope of Work and negotiate a Contract price within the available funding for the Work. If an agreement is reached between the parties on the reduction in the scope of Work for the project Bid, an Addendum will be issued to the Bid listing the agreed upon reduction in the scope of Work, the lowest responsive and responsible Bidder will amend its Bid based upon the proposed reduction in the scope of the Work and the Owner will award a Contract within the funds available for the Work based upon the amended Bid. If the Owner and the lowest responsive and responsible bidder cannot negotiate a Contract within available funds, all Bids shall be rejected.

ARTICLE 6 - POST-BID INFORMATION

Modify Paragraphs:

- 6.2 Owner's Financial Capability: Delete paragraph 6.2 in its entirety.
- 6.3.3 Delete this paragraph in its entirety.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

Delete subparagraphs 7.2.1, 7.2.2 and 7.2.3 and replace with the following:

- 7.2.1 The successful Bidder shall deliver the required bonds to the Owner in accordance with Subparagraph 11.4.1 of the Supplementary General Conditions.

END OF SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

SECTION 002600
PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids in accordance with Instructions to Bidders.
- B. Procurement Prior Approval Requests: Requests for approval of products or manufacturers from those required by the Contract Documents as defined by product selection procedures in Section 016000 "Product Requirements."
 - 1. Procurement prior approval is required when products or manufacturers are listed in specifications under "Sole Product," "Sole Manufacturer," "Limited List of Products," or "Limited List of Manufacturers" introductory paragraphs.
 - 2. Procurement prior approval is not required when products or manufacturers are listed in specifications.
 - 3. Procurement prior approval is not required when a non-limited list of Manufacturers or Products is provided if the product complies with the requirements.
 - 4. Requests to add products to the non-limited List of Manufacturers or Products for manufacturers and products that comply with the requirements but are not named will not be accepted by the Architect during the Bid Period.
- C. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See the General Conditions and Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
1. Extensive revisions to the Contract Documents are not required.
 2. Proposed changes are in keeping with general intent of the Contract Documents, including level of quality of the Work represented by requirements therein.
 3. Request is fully documented and properly submitted.

1.4 SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
 2. Submittal Format, Electronic: Submit Procurement Substitution Request, using format provided on Project web-based bidding management software site.
 - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and Drawing numbers.
 - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
 - 1) List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - 2) Product data, including drawings and descriptions of products and fabrication and installation procedures.
 - 3) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
 - 4) Copies of current, independent third-party test data of salient product or system characteristics.
 - 5) Samples where applicable or when requested by Architect.
 - 6) Detailed comparison of significant qualities of proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - 7) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 8) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
 - 9) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate proposed substitute.

- c. Provide certification by manufacturer that proposed substitute is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to product or equipment specified in the application indicated.
- d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

- 1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all Bidders of acceptance of proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

- C. Architect's approval of substitute during bidding does not relieve Contractor of the responsibility to submit required Shop Drawings and to comply with all other requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DOCUMENT 004110
BID FORM – STIPULATED SUM

Job Title (Hereinafter Project):
**Bedford County Department of Social Services
Falling Creek Road, Bedford, Virginia 24523**

To: Bedford County (Hereinafter "Owner")
Mr. Doug Coffman

Date: _____

Submitted by: _____
(full name)

(full address) _____

1. BASE BID:

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as Principal or Principals is/are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company, or parties making a bid or proposal; and that it is, in all respects, fair and in good faith without collusion or fraud.

The bidder further declares that he has examined the Place of the Work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined all matters referred to in the Instructions to Bidders and the Contract Documents relative thereto prepared by Spectrum Design, P.C. for the above mentioned project; and that he has satisfied himself relative to the work to be performed within the established time.

He proposes and agrees, if this proposal is accepted, to contract with the Owner in the form of contract specified to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor, and pay all State and local sales taxes necessary to complete the Project in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents with a definite understanding that no money will be allowed for extra work except as set forth in the Contract Documents, for the following amount:

BASE BID (including the following parts):

PART A: DEPARTMENT OF SOCIAL SERVICES CONSTRUCTION

Lump sum price for the construction of the Department of Social Services and associated work complete and in accordance with the Plans and Specifications.

PART A: \$ _____

(_____ Dollars)

PART B. - REMOVAL OF UNSUITABLE MATERIAL AND REPLACEMENT WITH SATISFACTORY SOIL MATERIAL.

Unsuitable soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312323 Backfilling. Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (600) cy @ \$ _____ per cy = _____

PART B = _____ Dollars (\$ _____)

PART C. – MASS ROCK EXCAVATION AND REPLACEMENT WITH SATISFACTORY SOIL MATERIAL.

Classified mass rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312318 Rock Removal. Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (450) cy @ \$ _____ per cy = _____

PART C = _____ Dollars (\$ _____)

PART D. – TRENCH ROCK EXCAVATION AND REPLACEMENT WITH SATISFACTORY SOIL MATERIAL.

Classified trench rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312318 Rock Removal. Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (300) cy @ \$ _____ per cy = _____

PART D = _____ Dollars (\$ _____)

TOTAL BASE BID AMOUNT (Sum of PARTS A, B, C & D) IS:

_____ Dollars (\$ _____)

2. TIME OF COMPLETION:

The undersigned agrees that all work under this contract shall be substantially completed in 548 consecutive calendar days and Final Completion shall be achieved within thirty (30) consecutive calendar days after the date of Substantial Completion as determined by the A/E.

3. CONTRACT SECURITY:

The undersigned agrees, if awarded the contract, to furnish and deliver to the Owner an executed performance and payment bond in accordance with the requirements of the Contract Documents.

4. PROPOSAL ACCEPTANCE:

If undersigned is notified of proposal acceptance within **thirty (30)** days following opening of bids, he agrees to be prepared to execute a contract for work for compensation stated in the bid form and in the form of agreement referenced in the Project Manual within **ten (10)** days after date of Notice of Award, including required Contract Security.

5. BID SECURITY:

The undersigned agrees to requirements of the Contract Documents relative to "Bid Security." This bid may be rejected if not accompanied by a guarantee in the specified amount. Any certified checks may be uncollected at the risk of bidders submitting them.

In the event the bid is not accepted within the time stated above, the required Bid Security will be returned to the undersigned, in accordance with the provisions of the Instruction to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

6. ADDENDUM/BULLETIN RECEIPT:

The undersigned acknowledges receipt of the following addenda numbered:

Addendum # _____, dated _____.	Addendum # _____, dated _____.
Addendum # _____, dated _____.	Addendum # _____, dated _____.

7. BID FORM SIGNATURES:

Signed: _____
(Signature of authorized signing officer and title)

Name: _____
(Printed full name of authorized signing officer and title)

For: _____
(Printed full name of firm, company or corporation)

State of Incorporation: _____

Date: _____

(business mailing address – 3 lines provided)

If a bidder is a joint venture or partnership, add additional forms of execution for each member in the appropriate form or forms as above.

(SEAL)

____ Class A contractor, registered under Title 54.1, Chapter 11, Code of Virginia, as amended, Certificate No. _____, 20____

____ Registration not required under Chapter 11, Title 54.1, Code of Virginia.

END OF BID FORM

SECTION 006000
PROJECT FORMS

PART 1 - GENERAL

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions to be used for Project:
 - 1. AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."
 - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
 - 2. The General Conditions are incorporated by reference.
 - 3. The Supplementary Conditions for Project are separately prepared and included in the Project Manual.

1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from AIA Contract Documents: <https://aiacontracts.com>.
- C. Preconstruction Forms:
 - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond" and AIA Document A312-2010 "Payment Bond."
 - 2. Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."
- D. Information and Modification Forms:
 - 1. Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
 - 2. Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."
 - 3. Change Order Form: AIA Document G701-2017 "Change Order."
 - 4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."
 - 5. Form of Change Directive: AIA Document G714-2017 "Construction Change Directive."
- E. Payment Forms:
 - 1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."

2. Payment Application, Lump Sum Project: AIA Document G702-1992 "Application and Certificate for Payment" and G703-1992 "Continuation Sheet."
3. Form of Contractor's Sworn Statement: [AIA Document G907-2022 "Sworn Construction Statement"]<Insert name of applicable document>.
4. Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims".
5. Form of Affidavit of Release of Liens on Progress Payments: AIA Document G901-2022 "Conditional Waiver and Release on Progress Payment" and AIA Document G902-2022 "Unconditional Waiver and Release on Progress Payment".
6. Form of Affidavit of Release of Liens on Final Payments: AIA Document G903-2022 "Conditional Waiver and Release on Final Payment" and AIA Document G904-2022 "Unconditional Waiver and Release on Final Payment".
7. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DOCUMENT 006313.13
REQUEST FOR INTERPRETATION FORM (RFI), BIDDING PHASE

PART 1 - GENERAL

1.1 SUMMARY

- A. Bidders: Utilize this form to request information required for clarifications and interpretations of the Bidding Documents.
- B. Refer to Document 002113 "Instructions to Bidders" for instructions for submittal of this form and for definitions used on this form.
- C. Response to this request by the Architect will be in the form of a written Addendum issued to all Bidders. If response to request is not published, use specified product.
- D. Form follows this section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PRE-BID
REQUEST FOR INTERPRETATION

PROJECT INFORMATION

Project Name: Bedford County Department of Social Services
Project Location: Falling Creek Road
Owner: Bedford County
Architect: Spectrum Design PC
Architect Project Number: 24112

BIDDING REQUEST INFORMATION

Bidder: _____.

Email: _____.

Specification Section No.: _____.

Drawing Sheet/Detail Number: _____.

INQUIRY

Bidder's Inquiry: _____

_____.

Signed: _____

Date: _____

SECTION 006325
REQUEST FOR SUBSTITUTION FORM, CONSTRUCTION PHASE

PART 1 - GENERAL

1.1 SUMMARY

- A. Contractor: Utilize this form to request consideration of an unnamed manufacturer, product, or specified fabrication method prior to commencing submittal preparation when use of specific manufacturers, products, or fabrication methods are required by the specifications.
- B. Refer to Section 012500 "Substitution Procedures" for instructions for submittal of this form and for definitions used on this form.
- C. This form is not required to be submitted when named products are introduced by the phrase "Available products include ..." unless the intended product differs substantially from the requirements of the Contract Documents.
- D. Response to this request by the Architect will be in the form of a written Modification or other document as described in the Contract Documents.
- E. Form follows this Section.

1.2 ARCHITECT'S ACTION

- A. Architect's response to Request for Substitution will be as described in Section 012500 "Substitution Procedures."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR SUBSTITUTION
CONSTRUCTION PHASE

PROJECT INFORMATION

Project Name: Bedford County Department of Social Services
Project Location: Falling Creek Road
Owner: Bedford County
Architect: Spectrum Design PC
Architect Project Number: 24112

REQUEST INFORMATION

Specification Section and Paragraph No.: _____.

Drawing Sheet/Detail Number: _____.

REQUEST FOR SUBSTITUTION

Substitution for Cause: Indicate reason for request:

1. ☐ Specified product not available within Project schedule.
2. ☐ Specified product not compatible with other approved products.
3. ☐ Specified warranty not available.

Substitution for Convenience: Not allowed.

SPECIFIED PRODUCT

Specified Product/Fabrication Method (List name, description, model number, manufacturer):

_____.

PROPOSED PRODUCT

Specified Product/Fabrication Method (List name, description, model number, manufacturer):

_____.

Proposed Product Information (Note required point-by-point comparative data, to be attached to this form):

1. ☐ Point-by-point comparative product data
2. ☐ Test reports
3. ☐ Fabrication drawings
4. ☐ Samples (where applicable)

IMPACT OF PROPOSED SUBSTITUTION

List of related changes to the Work required by substitution: ☐ None. Explain:

_____.

Differences between specified product and proposed substitution: ☐ None. Explain:

_____.

Proposed product/fabrication method effects on other parts of the Work: ☐ None. Explain:

_____.

Proposed product/fabrication method effects on Contract Time: ☐ None. Explain:

_____.

Proposed product/fabrication method effects on Contract Sum: ☐ None. Explain:

_____.

CERTIFICATION

Undersigned certifies that:

1. Proposed substitution has been investigated by Contractor who has determined it to be equal or superior to specified product, except as noted herein.
2. Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
3. Same warranty will be furnished for proposed substitution as for specified product, if applicable, except as noted herein.
4. Same maintenance service and availability of replacement parts as for specified product, if applicable.
5. Proposed substitution does not affect dimensions and functional clearances, except as noted herein.
6. Proposed substitution will not affect Contract Time, except as noted herein.
7. Proposed substitution will not affect work of other trades, except as noted herein.
8. Proposed substitution provides comparable sustainable design properties as specified product, if applicable.

SUBMISSION OF REQUEST FOR SUBSTITUTION

For the Contractor:

Submittal Date: _____.

Firm name: _____.

Submitted by: _____.

Email: _____.

DOCUMENT 008110
SUPPLEMENTARY GENERAL CONDITIONS

1.1 SUMMARY

- A. Section Includes:
 - 1. Supplementary Conditions.
- B. Related Documents:
 - 1. Document 00 50 10 – Agreement – AIA.
 - 2. Document 00 70 10 – General Conditions – AIA.

1.2 SUPPLEMENTARY CONDITIONS

- A. These Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201-2017, and other provisions of the Contract Documents as indicated below. All provisions which are not so modified remain in full force and effect.
- B. The terms used in these Supplementary Conditions which are defined in the General Conditions of the Contract for Construction, AIA Document A201-2017, have the meanings assigned to them in the General Conditions.

ARTICLE 1 - CONTRACT DOCUMENTS

1.1 BASIC DEFINITIONS

Supplement subparagraph 1.1.3 - The Work as follows:

1.1.3 Related to the term "Work", where "as shown", "as indicated", "as detailed", or similar words are used, reference is made to the drawings accompanying this Project Manual. Where "as directed", "as required", "as permitted", "approved", or similar words are used, it shall be understood that the direction, permission, approval, or acceptance of the Architect-Engineer is intended unless stated otherwise.

Supplement subparagraph 1.1.5 - The Drawings as follows:

1.1.5 The term "Drawings" means the drawings enumerated in the Index to Drawings.

Add subparagraphs 1.1.9 through 1.1.17 as follows:

1.1.9 Addendum
The term "addendum" or "addenda" means any revision to the Contract which has been duly issued to prospective bidders prior to the time stipulated for the opening of Bids.

1.1.10 Clarification
The term "clarification" means answers to questions or additional comments provided to clarify the intent of the Drawings or Specifications raised during the bidding period prior to the opening of bids. This may or may not be made part of an Addendum.

1.1.11 Prime Bidders

The term "prime bidders" shall mean Contractors bidding separately on the Work or on separate phases of the Work. The term prime subcontractors shall mean the Mechanical, Plumbing, and Electrical subcontractors bidding to the general Contractors on their respective phases of the Work.

1.1.12 G.C.

The term "in G.C." shall mean that the portion of the Work referred to is to be included in the General Contract and does not mean literally that the actual work is to be performed by the General Contractor. The Contract is between the General Contractor and the Owner and the General Contractor is totally responsible for the performance of all phases of the Work included in the Contract, whether it be performed by him or by his subcontractors.

1.1.13 N.I.C.

The term "N.I.C." means that the portion of the work referred to is not included in the General Contract.

1.1.14 Products

The term "Products" as used in these Contract Documents refers to new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for re-use.

1.1.15 Furnish

Except as otherwise defined in greater detail, where required of the Contractor, the term "furnish" is used to mean "supplying and delivering to the project site, unloading, and inspecting for damage.

1.1.16 Install

Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including the actual "unpacking, assembly, erection, applying, placing, anchoring, working to dimension, finishing, curing, protecting, cleaning and similar operations making ready for use", as applicable in each instance.

1.1.17 Provide

Provide shall mean to furnish and install.

1.2 - CORRELATION, AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 Add subparagraphs 1.2.1.1 and 1.2.1.2 as follows:

1.2.1.1 Plumbing, Mechanical and Electrical drawings are diagrammatic, showing general locations and arrangements of piping, wiring, equipment and specialties; not necessarily showing all required offsets, conditions and appurtenances required for maximum practical accessibility for operation, maintenance and clearances. Coordinate this Work in order to achieve the required Work and notify the Architect immediately of conditions which do not comply or will not allow for this condition."

1.2.1.2 Should the Drawings and the Specifications disagree in themselves or with each other, provide the better quality or greater quantity of Work unless otherwise directed by written Addendum or Change Order to the Contract.

Add subparagraphs 1.2.4 through 1.2.8 as follows:

1.2.4 In the Contract Documents where detailed information is lacking or interpretation is not clear, secure required information from the Architect before proceeding with the work. Failure to request clarification prior to bid shall oblige Contractor to furnish the highest quality of material or construction method reasonably inferable by the Contract Documents. Discrepancies pertaining to the work shall be called to the attention of the Architect before proceeding with the work. For items that are detailed and/or specified but not distinctly located on the plans, the Architect shall determine the location of such items.

1.2.5 Figured dimensions are to be followed in preference to measurements by scale. Large scale or full size drawings will take precedence over smaller scale drawings.

1.2.6 In the event that a discrepancy is found between the Drawings and the Specifications, the more stringent or costly requirement shall supercede. In cases where there is no significant difference in requirements, the Specifications shall supercede.

1.2.7 Where requirements specifically set forth in the Agreement are in conflict with other Contract Documents, the Agreement shall govern.

1.2.8 Where there is a conflict between the requirements of the General Conditions of the Contract and the Supplemental Conditions, the requirements of the Supplemental Conditions shall govern, except where the requirements set forth in the Supplemental Conditions are contrary to law, in which case the legal requirements shall govern. The General Conditions of the Contract shall take precedence over other Contract Documents except for the Agreement or Supplemental Conditions.

ARTICLE 2 - OWNER

2.1 DEFINITION

Delete paragraph 2.1.2 in its entirety.

2.4 OWNER'S RIGHT TO STOP THE WORK

2.4.1 Add the following to the end of Subparagraph 2.3.1:

"Failure of the Owner to notify the Contractor of necessary corrections or to stop the Work shall not relieve the Contractor of any responsibilities or obligations of the Contract Documents."

Add new paragraph 2.5 and Subparagraph 2.5.1:

2.5 ADDITIONAL RIGHTS

2.5.1 The rights stated in Article 2 shall be in addition to and not in limitation of any other rights of the Owner granted in the Contract Documents or at law or in equity.

ARTICLE 3 - CONTRACTOR

3.2 – REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Add to paragraph 3.2.1 as follows:

The scope of work requirements for various disciplines is found throughout the drawings and various divisions of these specifications. It is the Contractor's obligation to review the drawings and specifications as a whole and comply with the requirements for the Work wherever those requirements may be located in the Contract Documents.

3.3 – SUPERVISION & CONSTRUCTION PROCEDURES

Add clause 3.3.1.1 as follows:

3.3.1.1 Contractor shall be solely responsible for layout and scheduling of the Work resulting in its accurate and timely completion.

3.4 – LABOR AND MATERIALS

Add clause 3.4.1.1 as follows:

3.4.1.1 Labor shall include all fringe benefits, pension benefits and unemployment taxes provided for those performing the Work, whether or not such benefits and taxes are in effect at the time the construction contract is executed.

Add paragraph 3.4.4 as follows:

3.4.4 No later than ninety (90) days after execution of the Contract, the Owner and Architect will consider written request(s) for the substitution of products in place of those specified – NO EXCEPTIONS, except in the case of discontinued / unavailable products. By making such request(s) for substitution, the Contractor:

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

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

.3 certifies that the cost data presented is complete and includes all related costs under this Contract including the Architect's redesign costs, if required and identified by Architect as part of the review, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

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

3.5 – WARRANTY

Add subparagraph 3.5.1 through 3.5.6 as follows:

3.5.1 Except as otherwise specified, all Work shall be warranted and guaranteed by the Contractor against defects or non-conformities in materials, equipment, or workmanship for a period of one full calendar year commencing on the date of Substantial Completion for the last phase of work, in cases where the project is turned over to the Owner in phases.

3.5.2 If, within any warranty or guarantee period, repairs or changes are required in connection with guaranteed Work which, in the opinion of the Architect/Engineer is rendered necessary as the result of the use of materials, equipment or workmanship which are defective or do not conform to the terms of the Contract Documents, the Contractor shall promptly, upon receipt of notice from the Owner and without expense to the Owner:

1. Place in satisfactory condition in every particular all of such guaranteed Work, correcting all defects therein; and
2. Make good all damage to the building or site, or equipment or contents thereof, which, in the opinion of the Architect/Engineer, is the result of the use of materials, equipment or workmanship which are defective or do not conform to the terms of the Contract Documents; and
3. Make good any Work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.

3.5.3 In any case wherein fulfilling the requirements of the Contract or any guarantee embraced in or required thereby, the Contractor disturbs any Work guaranteed under another Contract, he shall restore such disturbed Work to a condition satisfactory to the Architect/Engineer and guarantee such restored Work to the same extent as it was originally guaranteed.

3.5.4 If the Contractor, after notice, fails to proceed within three (3) days to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expense incurred in connection with such corrections.

3.5.5 All special guarantees applicable to specific parts of the Work that may be stipulated in the Specifications or other Contract Documents shall be subject to the terms of this paragraph.

3.5.6 There will be one final inspection of the project by the Architect/Engineer and the Owner along with the Contractor between the eleventh and twelfth months of the warranty period. Any Work that is found to be defective or not in conformity with the Contract Documents shall be corrected by the Contractor within thirty (30) days of the issuance of notice of such Work that is found to be defective or not in conformity with the Contract Documents.

3.7 – PERMITS, FEES, AND NOTICES

Add clauses 3.7.1.1 thru 3.7.1.4 as follows:

3.7.1.1 Plan Review Fees

The Owner will have paid for preliminary plan review by the code official having

jurisdiction prior to the project going to bid. Plan review fees should not be included in the Contractor's bid.

3.7.1.2 Contractor shall secure and pay for the Land Disturbing Permit, including bonds as required by Local Governing Authority.

3.7.1.3 Off-site Borrow or Waste Areas

The Contractor shall assume all responsibility for his use of any off-site borrow and/or waste area which shall include, but not be limited to; liability, surveying, design, permits, fees, etc. associated therewith.

3.7.1.4 Unless otherwise provided in the Contract Documents, the Contractor is responsible for obtaining utilities for the Project and providing the constructed work relating to Project utilities as shown on the Drawings. Responsibility for *payment of fees* associated with providing utilities to the Project shall be as follows:

- a. Any fees assessed by entities for providing *permanent* utilities to the Project shall *be paid directly to the utilities by Owner*. These include "tap fees" and "electrical connection and service fees." Contractor shall coordinate the permanent utilities and the entity's related work to comply with the construction schedule.
- b. Any fees assessed by entities for providing *temporary* utilities to the Project for use by Contractor during construction of the Project shall be paid by the Contractor. The Contractor's payment of fees for *temporary* utilities shall be included in the Base Bid and Contract Sum and will not be reimbursed by the Owner.

Change subparagraph 3.7.3:

Replace "knowing it" with "that the Contractor knows or reasonably should know."

Add subparagraph 3.7.6 as follows:

3.7.6 Where method of construction or installation of materials or equipment is not indicated in the Contract Documents and such construction or installation is covered by codes, ordinances, or regulations in force in the locality of the Work, the Work shall be performed in accordance therewith as part of the Contract. In the absence of applicable local codes, State Codes shall apply.

3.8 - ALLOWANCES

Add clause 3.8.1.1 thru 3.8.1.3 as follows:

3.8.1.1 If applicable to this project, certain requirements of the Work related to each allowance are shown and specified in the Contract Documents. The allowance has been established in lieu of additional requirements for that work, and further requirements thereof (if any) will be issued by Change Order.

Supplement Clause 3.8.2.2 as follows:

3.8.2.2“(include also uncrating and storage, protection from elements and damage, and finishing)”

Delete clause 3.8.2.3 in its entirety if a dedicated section for Allowances is included in the project manual. Otherwise, this clause applies.

Add clause 3.8.2.4 as follows:

3.8.2.4 The Owner reserves the right to establish the actual quantity of work-in-place by an independent quantity survey, measure, or count. Whenever the actual cost is more than the allowance value, additional mark-up for Contractor's overhead and profit shall not exceed 10% of the difference between the cost and the allowance.

Add clause 3.8.4 as follows:

3.8.4 Change Order Data (Allowances):

.1 Where applicable, include in each change order proposal both the quantities of products being purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish data to substantiate quantities. Indicate applicable taxes, delivery charges, and amounts of applicable trade discounts.

3.9 - SUPERINTENDENT

Add clause 3.9.1.1 as follows:

3.9.1.1 The Contractor's superintendent shall be experienced in the construction of projects of this type and scope. The Contractor's superintendent shall give special attention to Work nearing completion and shall remain on site and in active control until all phases of the work have been completed, the final punch list is completed, and the project in its entirety is acceptable to the Owner. The practice of substituting another superintendent for the purpose of “closing out” this project shall be strictly prohibited, unless the superintendent is no longer employed by the Contractor.

Add the following new Subparagraphs 3.9.4 and 3.9.5

3.9.4 The Superintendent employed by the Contractor shall have a minimum of five (5) years commercial experience as the primary Superintendent on projects of similar size, type and complexity as the Work. The Contractor shall submit to the Architect a resume and other supporting documentation showing that the proposed Superintendent is competent and has the minimum work experience required to execute the Work. The Owner reserves the right to request additional supporting documentation regarding the proposed Superintendent's qualifications and to require the Contractor to propose an alternate Superintendent who better meets the requirements contained in this Article, as may reasonably be determined by the Owner. The Contractor shall notify the Architect and Owner in writing of any proposed replacement of the Superintendent. The Contractor shall not replace a competent Superintendent without prior written approval from the Owner. The requirements contained in this Article shall apply to any proposed

replacement Superintendent, regardless if the proposed tenure is to be temporary or permanent.

3.9.5 The Contractor shall employ a Project Manager to be assigned to the Work. The Project Manager employed by the Contractor shall have a minimum of five (5) years commercial experience as Project Manager on projects of similar size, type and complexity as the Work. The Contractor shall submit to the Architect a resume and other supporting documentation showing that the proposed Project Manager is competent and has the minimum work experience required to execute the Work. The Owner reserves the right to request additional supporting documentation regarding the proposed Project Manager's qualifications and to require the Contractor to propose an alternate Project Manager who better meets the requirements contained in this Article, as may reasonably be determined by the Owner. The Contractor shall notify the Architect and Owner in writing of any proposed replacement of the Project Manager. The Contractor shall not replace a competent Project Manager without prior written approval from the Owner. The requirements contained in this Article shall apply to any proposed replacement Project Manager, regardless if the proposed tenure is to be temporary or permanent. The Project Manager shall not act as the Superintendent or replacement for the Superintendent without written approval from the Owner.

3.10 – CONTRACTOR'S CONSTRUCTION SCHEDULES

Add to subparagraph 3.10.4 through 3.10.7 as follows:

3.10.4 An updated construction schedule, acceptable to the Architect and Owner shall be submitted by the Contractor prior to certification of each Application for Payment.

3.10.5 The work shall be executed at such a rate as will assure meeting the specified Substantial Completion dates within the time/dates provided in the specifications. By execution of the Contract, the Contractor represents it has analyzed the work, the materials and methods involved, the systems of the building, availability of qualified labor, restrictions of the site, constraints imposed, workload and capacity to perform the work, and agrees that the specified times are reasonable considering the known existing conditions prevailing in the locality of the work, including weather conditions, and other factors, with reasonable allowance for variations from average or ideal conditions.

3.10.6 The Substantial Completion dates provided are considered essential to the satisfactory performance of this Contract and to the coordination of all work on the project. The Owner reserves the right to require the Contractor to prosecute the work in accordance with the Contractor's Construction Schedule and to satisfactorily complete the work by the Substantial Completion date. The Contractor is responsible to provide the operations, manpower, resources, materials, and all items and work necessary to complete the work and meet the Substantial Completion and Final Completion dates provided. The Contractor understands and agrees that: the Substantial Completion, Final Completion, actual start and completion dates, rate of progress, and coordination are essential conditions of this project. It is understood and agreed that TIME IS OF THE ESSENCE and the Contractor agrees to diligently follow and adhere to the schedule with due diligence so as to execute the work within the Substantial Completion and Final Completion dates and time frames stipulated in the Contract Documents. The Contractor shall take all necessary steps, which may include overtime, double shifts, weekends, and holiday work to complete this work and meet the Substantial Completion and Final Completion dates stipulated in the Contract Documents.

3.10.7 Refer to Section 01320 - CONSTRUCTION PROGRESS DOCUMENTATION for specific requirements on this subject.

3.11 – DOCUMENTS AND SAMPLES AT THE SITE

Add subparagraph 3.11.1 and 3.11.2 as follows:

3.11.1 The Contractor shall keep an accurate record and location of all work, both interior and exterior. On completion of the Work, one print of each of the Drawings that is applicable shall be neatly and clearly marked in color to show all variations between the work actually provided and that indicated on the Drawings. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as may be necessary for legibility and clear portrayal of the as-built construction. Location of as-built utilities shall be accurate and located by dimensions. These drawings shall be approved by the Architect before acceptance. Retainage will not be released, in whole or in part, until the requirements of this section are completed.

3.11.2 In addition to the above, all subcontractors shall have up to date drawings and specifications on site and in use by the foreman in charge of the work.

3.12 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

Add subparagraph 3.12.11 thru 3.12.5 as follows:

3.12.11 Refer to Section 01330 – SUBMITTAL PROCEDURES for specific requirements on this subject.

3.12.12 Shop drawings shall be submitted in such number of copies as specified, and if not specified, such that three (3) copies may be retained by the Architect. Submissions be shall accompanied by a letter of transmittal in duplicate, which shall list and properly identify the contents of such submission. Shop drawings shall be consecutively numbered and clearly labeled with name of the project and date. Shop drawings shall be submitted in such sequence or groups that all related items may be checked together. Shop drawings not so submitted will be returned without action.

3.12.13 The Contractor shall submit to the Architect for approval a listing of all submittals required by the Contract Documents, fixing the dates for the submission of shop drawings, samples and product data.

3.12.14 In checking and approving shop drawings, the Architect will not be responsible for checking dimensions or quantities; however it shall be understood that if the Architect so chooses, this checking is done as a convenience to the Contractor and it shall not relieve the Contractor of the responsibility for furnishing any or all the items and quantities shown in the Contract Documents. The act of approving shop drawings shall not be construed as authorization for any increase in the cost of the Work.

3.12.15 Samples shall be delivered with all shipping charges prepaid. Each sample shall bear a label indicating the material represented, the name of the producer and the title of the project. Approval of a sample shall not be construed to change or modify any contract requirement or price. Approved samples shall be retained by the Architect until completion of the project.

3.13 – USE OF SITE

Add subparagraph 3.13.1 and 3.13.2 as follows:

3.13.1 The Contractor shall position field offices, equipment, and supply trailers, temporary toilet facilities, and other large construction related items so as to not interfere with, hinder, or endanger the public when the project is occupied by the Owner. Refer to Division 1 sections regarding temporary provisions for additional requirements on this subject.

3.13.2 Should the Contractor require additional land for temporary construction facilities or for storage of materials and equipment other than the areas available on the site, or as otherwise furnished by the Owner, he shall provide such other lands and access thereto entirely at his own expense and without liability to the Owner.

3.14 - CUTTING & PATCHING

Add subparagraphs 3.14.3 and 3.14.4 as follows:

3.14.3 Each subcontractor shall leave all such chases, holes, or openings straight, true and of the proper size in his own work, as may be necessary for the proper installation of another subcontractor's work, consulting with the subcontractor concerned regarding proper location and size of same. No excessive cutting will be permitted nor shall any piers or other structural members be cut without the consent of the Architect. After such work has been installed, subcontractor shall carefully fit around, close up, repair, patch, and point up his material as directed, to the entire satisfaction of the Architect. All this work shall be done with proper tools and by careful workmen of the particular trade to which such work belongs. Each specification section shall include cutting and patching, plumbing, or earthwork for that trade section unless otherwise specified.

3.14.4 See Section 017310 – CUTTING AND PATCHING for further requirements.

3.15 – CLEANING UP

3.15.2 Add the following sentence:

“Reimbursement amount may be deducted from funds to be paid to the Contractor, or as an option, the Contractor shall pay invoices from Owner’s cleaning personnel directly, within ten (10) days of the date of any statement of amounts due.”

Add subparagraph 3.15.3 as follows:

3.15.3 The Contractor shall thoroughly clean and leave reasonably dust free, to the satisfaction of the Architect, all finished surfaces on the interior of the

buildings, including the removal of all paint spatters, concrete spatters, and other defacements of the work. See Section 017700 – CLOSEOUT PROCEDURES for further requirements.

3.18 - INDEMNIFICATION

Supplement subparagraph 3.18.1 as follows:

3.18.1 This indemnification shall also include loss or damage as a result of injury, and loss or damage to adjoining or adjacent structures and their premises as a result of the performance of the work.

ARTICLE 4 - ARCHITECT

4.1 - GENERAL

Add clause 4.1.1.1 as follows:

4.1.1.1 The terms "Architect" or "Engineer" means SPECTRUM DESIGN, P.C., the firm engaged by the Owner for architectural and/or engineering services related to the work. These terms as used throughout the Contract Documents include authorized representatives of the firm, including consultants.

ARTICLE 5 - SUBCONTRACTORS

5.2 – AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

Add clause 5.2.1.1 as follows:

5.2.1.1. The list of subcontractors and material suppliers furnished under 5.2.1 shall be submitted within twenty-one (21) calendar days of the date of the Contract for Construction and shall contain the address, telephone number, and principal contact person for each such entity. The Contractor shall include the Virginia Contractor's license number and class for each subcontractor.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Add the following new Subparagraph 6.1.5:

6.1.5 The Owner shall have the right to deliver and move furniture and equipment in the building prior to completion of the Work by the Contractor if furniture and equipment does not seriously interfere with the Contractor's operations. Questions of what constitutes interference shall be referred to the Architect and his decision shall be final.

ARTICLE 7 - CHANGES IN THE WORK

7.2 – CHANGE ORDERS

Add subparagraph 7.2.2 as follows:

7.2.2 Refer to Section 012500 – CONTRACT MODIFICATION PROCEDURES, for additional requirements on this subject.

Change subparagraph 7.3.7 as follows:

7.3.4 Delete the words, “an amount for overhead and profit as set forth a reasonable amount” and substitute, “an amount for overhead and profit in accordance with the schedule set forth in subparagraph 7.3.11 below.”

Add the following subparagraph 7.3.11:

7.3.11 The amount for overhead and profit combined, included in the total cost to the Owner, shall not exceed the following schedule:

- .1 For the Contractor, for any Work performed by his own forces, fifteen percent (15%) of the costs of the changed Work.
- .2 For the Contractor, for Work performed by his subcontractor or any other lower tier subcontractor, seven percent (7%) of the amount due the subcontractor.
- .3 For each subcontractor included, for any Work performed by the subcontractor's own forces, fifteen percent (15%) of the costs of the changed Work.
- .4 Cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.3 and 7.3.7.

ARTICLE 8 - TIME

8.1 - DEFINITIONS

Add subparagraph 8.1.5 as follows:

8.1.5 Time of Completion (Substantial Completion & Acceptance by Owner) is identified in Article 9.11 – LIQUIDATED DAMAGES of these Supplementary General Conditions, and in Document 00501 - AGREEMENT.

8.2 - PROGRESS AND COMPLETION

Add the following to the end of Subparagraph 8.2.1:

“ . . . and the Contractor is capable of properly completing the Work within the Contract Time.”

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 – SCHEDULE OF VALUES

Add subparagraph 9.2.1 as follows:

9.2.1 Refer to Section 012900 – PAYMENT PROCEDURES, for additional requirements on this subject.

9.3 - APPLICATIONS FOR PAYMENT

9.3.2 ADD the following new Subparagraph 9.3.2.1:

9.3.2.1 The Contractor shall provide invoices, package slips, or other forms of supporting data for materials stored on-site claimed on the progress payment, unless it can otherwise be verified through on-site observation.

9.4 – CERTIFICATES FOR PAYMENT

Add subparagraph 9.4.3 as follows:

9.4.3 The issuance of a Certificate for Payment to the Owner shall not relieve the Contractor of responsibility for faulty materials or workmanship or operate to release the Contractor or his surety from any obligations under the contract or the performance bond.

9.6.2 Add the following new Subparagraphs 9.6.2.1, 9.6.2.2 and 9.6.2.3:

9.6.2.1 The Contractor shall take one of the two following actions within seven (7) days after receipt of amounts paid to the Contractor by the Owner for work performed by a Subcontractor under this Contract:

- a. Pay the Subcontractor for the proportionate share of the total payment received from the Owner attributable to the work performed by the Subcontractor under this Contract; or
- b. Notify the Owner and the Subcontractor, in writing, of its intention to withhold all or part of the Subcontractor's payment with the reason for nonpayment.

9.6.2.2 The Contractor shall pay interest to the Subcontractor on all amounts owed by the Contractor that remain unpaid after seven (7) days following receipt by the Contractor of payment from the Owner for work performed by the Subcontractor under this Contract, except for amounts withheld as allowed in Subparagraph 9.6.2.1(b), above. Unless otherwise provided under the terms of this Contract, such interest shall accrue at the rate of one percent (1%) per month. The Contractor's obligation to pay an interest charge to a Subcontractor may not be construed to be an obligation of the Owner.

9.6.2.3 The Contractor shall include in each of its subcontracts a provision requiring each subcontractor to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier Subcontractor.

9.7 - FAILURE OF PAYMENT

9.7 Delete Subparagraph 9.7 in its entirety.

9.8 – SUBSTANTIAL COMPLETION

Supplement subparagraph 9.8.1 as follows:

9.8.1 ...Work will not be considered “Substantially Complete” until all systems and equipment for the entire project have been tested and found to be functioning properly.

Supplement subparagraph 9.8.2 as follows:

9.8.2 ...The Architect will not certify Substantial Completion of the Work or any designated portion thereof unless or until a Certificate of Occupancy, or partial Certificate of occupancy has been granted by the governing authority.

Add paragraph 9.11 and subparagraphs 9.11.1 and 9.11.2 as follows:

9.11 – LIQUIDATED DAMAGES

9.11.1 The Contractor acknowledges that ‘Time is of the Essence’ and agrees that the Work must be Substantially Complete with all building systems fully operational and an Occupancy Permit obtained no later than the Substantial Completion date and the Work must be Finally Complete no later than thirty calendar (30) days after the Substantial Completion date (the ‘Final Completion date’).

If the Contractor fails to substantially complete the work by the substantial completion date as stated herein, the Contractor shall be liable to the Owner for liquidated damages for each calendar day of delay until the work is substantially complete as follows:

\$200/day beyond the initial Substantial Completion date as set forth in the Contract or as changed by Contract Modifications.

In addition to the above, if the Contractor fails to have all work under the project finally complete within 30 days after the initial Substantial Completion date as set forth in the Contract or as changed by Contract Modifications, the Contractor shall be liable to the Owner for liquidated damages in the amount of \$200/day for each calendar day of delay until Final Completion.

An executed Certificate of Substantial Completion does not constitute a modification to the Substantial Completion date as set forth in the Contract.

9.11.2 The Contractor acknowledges and agrees that the Owner has established the liquidated damages system and selected the liquidated damages amounts as the proper measure of damages which the Owner will suffer and incur per day by the failure of the Contractor to complete the Work by the contractually established Substantial Completion Date and Final Completion Date. The Contractor and the Contractor's surety agree that these liquidated

damages provisions are reasonable, valid, and enforceable and waive any right to claim that such liquidated damages are unenforceable as being penalties; are not reasonably related to potential actual damages; or otherwise challenge the validity of these liquidated damages. The Contractor acknowledges that these liquidated damages are an attempt to fairly estimate and compensate Owner for the damages which the Owner will suffer if the Contractor fails to perform by the dates established in this Contract which damages are difficult to determine using standard Contract damages methods.

The Contractor acknowledges that Owner would not enter into a Contract with the Contractor for the Work without the inclusion of these liquidated damages requirements.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 – SAFETY PRECAUTIONS AND PROGRAMS

Add the following to paragraph 10.1.1:

10.1.1.1 The Contractor shall have an approved written Accident Prevention Program and shall produce it when required by the Owner. The Contractor shall hold weekly meetings with all subcontractors to monitor compliance with all safety regulations. These regulations shall consist of applicable provisions of current State and Federal laws, statutes, codes and regulations including but not limited to the latest amendments of the following: Williams-Steigler Occupational Safety and Health Act of 1970, Public Law 91-956; Part 1910, Occupational Safety & Health Standards, Chapter 17 of Title 29, Code of Federal Regulations; Part 1926, Safety & Health regulations for Construction Chapter 17 of Title 29, Code of Federal Regulations. Each Contractor is solely responsible for the safety of his employees and others in the Work area.

10.1.1.2 All protection and safety barricades, devices, covers, etc., including at all roof areas shall be provided by each Contractor as it relates to the safe conduct of his Work in accordance with OSHA requirements.

10.1.1.3 Each Contractor will be responsible for all damage to personal or real property as a result of the Contractor's failure to provide protective measures in compliance with applicable statutes, laws, codes, or regulations.

Add subparagraph 10.1.2 as follows:

10.1.2 The safety of the employees of the Contractor and its subcontractors is the sole and exclusive responsibility of the Contractor. In performing this Contract, the Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies and equipment; and avoiding work interruptions and is required to comply with all applicable safety and health laws and regulations.

The Contractor and each subcontractor performing work on the site shall prepare and submit a copy of their safety program to the Owner and a copy to the Architect. Contractor shall hold weekly on-site safety meetings with a copy of the topic covered

and those workers attending to be submitted to the Owner. Owner, Architect and any other Owner's representatives will be provided access to on-site safety meetings.

Any review of the Contractor's safety program by the Owner or any of the Owner's representatives is for the sole benefit of the Owner; shall not establish a duty upon any of them; shall not extend to direct control over or charge of the acts or omissions of the Contractor, its subcontractors, agents or employees, or any other persons performing work on the Project; and shall not relieve the Contractor of its primary responsibility for job site safety.

The Contractor shall indemnify hold and save the Owner, and its other representatives, their agents and employees harmless from liability of any nature occasioned by its failure to adequately fulfill its obligations under Article 10.

Add new Subparagraph 10.1.3

10.1.3 All machinery, appliances and equipment furnished under the Contract shall be protected by adequate safety devices as required by the rules and regulations governing safety, as adopted by the Safety Codes Commission of the Commonwealth of Virginia.

10.2 – SAFETY OF PERSONS AND PROPERTY

Add subparagraph 10.2.8 as follows:

10.2.8 The Contractor shall brace, shore up, underpin, secure and protect as may be necessary, all parts of existing or new structures adjoining and in the vicinity of the site that may be affected in any way by excavating or other operations in connection with the execution of the Work in this Contract.

ARTICLE 11 - INSURANCE AND BONDS

11.1 – CONTRACTOR'S LIABILITY INSURANCE

Add subclause 11.1.1.4.1 as follows:

11.1.1.4.1 Certificate of Insurance must therefore evidence the elimination of "employee exclusion" clauses normally included.

Add clause 11.1.2.1 as follows:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits:

.1 Worker's Compensation:

.1 State: Statutory

.2 Applicable Federal (e.g., Longshoremen): Statutory

.3 Employer's Liability:

\$1,000,000 per Accident
\$1,000,000 Disease, Policy Limit
\$1,000,000 Disease, Each Employee

.2 Comprehensive or General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

.1 Bodily Injury:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.2 Property Damage:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.3 Products and Completed Operations to be Maintained for two (2) years after final payment.

.4 Property Damage Liability Insurance shall provide for X, C, and U Coverage.

.5 Broad Form Property Damage Coverage shall include Completed Operations.

.3 Contractual Liability:

.1 Bodily Injury:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.2 Property Damage:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.4 Personal Injury, with Employee Exclusion deleted:
\$1,000,000 Aggregate

.5 Business Auto Liability (including owned, non-owned and hired vehicles):

.1 Bodily Injury:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.2 Property Damage:
\$1,000,000 Each Occurrence
\$1,000,000 Aggregate

.6 If the General Liability coverage are provided by a Commercial Liability policy, the:

- .1 General Aggregate shall not be less than \$1,000,000 and it shall apply, in total, to this project only.
- .2 Fire Damage Limit shall not be less than \$1,000,000 on any one Fire.
- .3 Medical Expense Limit shall not be less than \$1,000,000 on any one person.
- .7 Umbrella Excess Liability
\$1,000,000 over primary insurance
\$1,000,000 retention for self-insured hazards each occurrence
- .8 Aircraft Liability (owned and non-owned) when Aircraft are used in the performance of the Contract:
 - .1 Limits are proposed by the Contractor for Owner's approval.

ADD the following to the end of subparagraph 11.1.3:

11.1.3 "... Furnish one copy each of Certificates of Insurance herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by Subparagraph 11.1.2.1. The form of the Certificate shall be AIA Document G705. If the insurance is written on a Commercial General Liability policy form, ACORD form 25S will be acceptable. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage and limits."

11.3 – PROPERTY INSURANCE

Change subparagraph 11.3.1:

"Unless otherwise provided, the Contractor 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 . . ."

Add subclause 11.3.1.2.1 as follows:

11.3.1.2.1 The Contractor shall provide, or assure that subcontractors and suppliers provide, insurance coverage for portions of the work stored off the site. If the Contractor requests payment for portions of the work stored off-site, then an insurance certificate indicating the materials insured, insured value, storage location, and identifying the Owner as the beneficiary (or insured), must accompany the payment request.

11.1.2 – PERFORMANCE BOND AND PAYMENT BOND

Delete Subparagraph 11.1.2 and substitute the following:

11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be

included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

Add clauses 11.4.1.1 thru 11.4.1.3 as follows:

11.4.1.1 The Contractor shall deliver the required bonds to the Owner not later than ten (10) days following the date the Contract is awarded, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

11.4.1.3 Add the following: Performance bond shall remain in force for a period of one year from the date of acceptance of the work covered by this contract.

Add the following subparagraph:

11.4.3 The bond value requirements are as follows:

1. Provide a 100 percent Performance Bond on AIA A312 or a standard surety bond form.
2. Provide a 100 percent Payment Bond on AIA A311 or a standard surety bond form.
3. Deliver bonds within 3 days after execution of the Contract.
4. This section shall not preclude the Contractor (at his option and at no additional cost to the Owner) from requiring Subcontractors to furnish like performance and payment bonds for the work provided in their Subcontracts.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.4 – TESTS & INSPECTIONS

Add clause 13.4.1.1 as follows:

13.4.1.1 Soils Testing Laboratory: A qualified independent Soils Testing Laboratory, which staffs a Professional Geotechnical Engineer, registered in Virginia (hereinafter Geotechnical Engineer), will be retained by the Owner to observe, test, and report performance of work in connection with Rough Grading, Excavating, Backfilling, Utility Trenching & Backfilling, and any other earthwork related concern as applicable as well as observation of the installation of subsurface utilities under this Contract. (See also ARTICLE 20)

Add subparagraphs 13.4.7, 13.4.8 and 13.4.9 as follows:

13.4.7 Any specified laboratory tests of materials and articles to be incorporated in the work shall be made by laboratories, bureaus or agencies approved by the Architect and the certified reports of such tests shall be submitted to the Architect. The Contractor shall furnish all samples of materials or articles required for those tests delivered to the testing laboratory or other designated agency properly identified and labeled. Failure of any material to pass the specified tests will be sufficient cause for refusal to consider, under this Contract, any further samples of the same brand or make of that material.

13.4.8 Samples of various materials delivered on the site or in place may be taken by the Architect for testing. Samples failing to meet the contract requirements will automatically void previous approvals of the items tested. The Contractor shall replace such materials or equipment to meet contract requirements except as provided in ARTICLE 12.3 - ACCEPTANCE NON-CONFORMING WORK.

13.4.9 The use of permanent equipment for temporary heat or other construction activities shall in no way affect warranty period for equipment. Warranty period shall commence when above-mentioned tests have been successfully performed.

Add the following Paragraph:

13.6 – EQUAL OPPORTUNITY

13.6.1 The Contractor shall maintain policies of employment as follows and in accordance with the Code of Virginia.

- .1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or other bias 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;
- .2 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;
- .3 Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

The Contractor will include the provisions of the foregoing paragraphs .1, .2 and .3 in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

13.7 Drug-free Workplace. During the performance of this Agreement, the Contractor agrees to (i) provide a drug-free workplace for the Contractor's employees; (ii) 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 Contractor's workplace and specifying the actions

that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) 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. "Drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a Contractor in accordance with the Virginia Public Procurement Act, 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.

13.8 Payment Clauses. The Contractor shall take one of the two following actions within seven (7) days after receipt of amounts paid to the Contractor by the Owner for work performed by the subcontractor under that contract:

.1 Pay the subcontractor for the proportionate share of the total payment received from the Owner attributable to the work performed by the subcontractor under that contract; or;

.2 Notify the Owner and subcontractor, in writing, of his intention to withhold all or a part of the subcontractor's payment with the reason for nonpayment.

The Contractor shall include a payment clause in all subcontracts that requires (i) individual Contractors to provide their social security numbers, and (ii) proprietorships, partnerships, and corporations to provide their federal employer identification numbers.

The Contractor shall pay interest to the subcontractor on all amounts owed by the Contractor that remain unpaid after seven (7) days following receipt by the Contractor of payment from the Owner for work performed by the subcontractor under that contract, except for amounts withheld as set forth above.

The Contractor shall include in each of its subcontracts a provision requiring each subcontractor to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier subcontractor.

13.9 In accordance with the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, P.L. 104-193, it is the policy of the Owner not to discriminate against faith-based organizations.

13.10 Firearms, drugs, alcohol, tobacco products, smoking, and/or any type of concealed weapons are not permitted on the project site. Anyone violating this requirement will be removed from the project and subject to dismissal. All Prime Contractors are required to include this provision in all subcontracts and other contract agreements relative to this project. The Prime Contractors are required to enforce this provision in regards to their own staff and employees.

13.11 The Contractor shall be responsible for ensuring a safe and secure environment for the students and staff at the facility from any of it's employees or sub-

Contractors/suppliers employees. To that end the Contractor shall endeavor to exclude any known felons from entering the site.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 - TERMINATION BY THE CONTRACTOR

Delete Subparagraph 14.1.1.3 in its entirety.

14.3 – SUSPENSION BY THE OWNER FOR CONVENIENCE:

Add subparagraph 14.3.3 as follows:

14.3.3 In no event shall termination of the Contract for convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

Add a new Subparagraph 14.4.4 as follows:

14.4.4 Upon seven (7) days' written notice to the Contractor and the Architect, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Contract. In such case, the Contractor shall be paid for all Work satisfactorily executed and any expense sustained, plus reasonable termination expenses.

ARTICLE 15 - CLAIMS AND DISPUTES

15.1.2 – NOTICE OF CLAIMS

Replace subparagraph 15.1.2 as follows:

15.1.2 The Contractor shall give written notice to the Architect of its intent to file a claim within ten (10) calendar days of the occurrence of the event giving rise to the claim.

Such written notice (i) shall clearly contain the express words "written notice of claim," and (ii) shall describe in reasonable detail the basis of the claim.

Within thirty (30) calendar days of the occurrence of the event giving rise to the claim the Contractor shall submit in writing to the Architect its actual claim and a certification that: the claim is made in good faith; supporting data are accurate and complete to the best of the Contractor's knowledge and belief; and the amount requested accurately reflects the contract adjustment for which it believes the Owner is liable. Such certification shall be executed by an officer or general partner of the Contractor having overall responsibility for the conduct of the Contractor's affairs.

The claim submitted shall set forth the amount of the adjustment to the Contract Price or Time that is being sought by the Contractor and provide all supporting information reasonably necessary to evaluate the claim.

Failure to adhere strictly to each and every requirement of this paragraph shall constitute a waiver by the Contractor of any claim for additional compensation or extended period of performance.

Add subparagraph 15.1.5.3 as follows:

15.1.5.3 Time Extension for Unusually Severe Weather - The time for completion as stated in the Contract Documents includes due allowance for normal bad weather days. This provision specifies the procedure for the determination of time extensions for unusually severe weather. In order for the Contractor to be awarded a time extension under this clause, the following conditions must be satisfied:

- .1 The weather experienced at the project site during the Contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.
- .2 The unusually severe weather must actually cause a delay to the critical path and to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor. Actual adverse weather delay days must prevent work on critical path activities for fifty percent (50%) or more of the Contractor's scheduled workday.

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location listed below, and will constitute the baseline for monthly weather time evaluations. The Contractor's Construction Schedule must reflect these anticipated adverse weather delays in all weather dependent activities. The following table is in terms of work days lost due to weather, not calendar days.

Roanoke, Virginia

January - 8 days	May - 7 days	September - 6 days
February - 10 days	June - 5 days	October - 8 days
March - 9 days	July - 6 days	November - 7 days
April - 7 days	August - 5 days	December - 7 days

Upon Notice to Proceed and continuing through-out the Contract, the Contractor will record daily the occurrence of adverse weather and resultant impact to normally scheduled work. Within five (5) work days after the first of each month, the Contractor must submit to the Architect and Owner a summary of weather day impacts.

If the actual total number of accumulated work days lost due to adverse weather from the start of Work until the building is enclosed exceeds the expected total number of lost work days for the same period (based on the table above), the time for Substantial Completion will be equitably extended by the appropriate number of calendar days.

No extension will be made for days of bad weather occurring after the building is enclosed or for weekends, holidays or other planned non-work days not clearly

identified by the Contractor in the Construction Schedule. Extensions of time due to unusually severe weather will not entitle the Contractor to any adjustment in the contract price.

Add subparagraph 15.1.5.4 as follows:

15.1.5.4 Determination of Additional Time: All requests for extensions to the contract time under any provision of this contract must be substantiated by a CPM schedule analysis based on the schedule in use on the project at the time of the impact.

Add subparagraph 15.1.5.5 as follows:

15.1.5.5 If there is an extension in the Time for Completion or the Contract Completion Date and if the Contractor is entitled to compensation under Article 15.1.5, and where there is no change in the Work, an itemized accounting of the following direct Site overhead expenses will be considered as allowable costs to be used in determining the compensation due the Contractor:

Site superintendent prorata salary, temporary Site office expense, temporary Site utilities including basic telephone service, electricity, heat, water, and sanitary/toilets. A ten percent (10%) markup of these expenses will be allowed to compensate the Contractor for home office and other direct or indirect overhead expenses.

Add subparagraph 15.1.7 as follows:

15.1.7 The Contractor and its Surety agree to make no claim for damages for delay in the performance of this contract occasioned by any act or omission of the Owner or the Architect or either of them or their representatives, and the Contractor agrees that any such claim may be fully compensated by an extension of time to complete performance of the work as provided herein.

15.2 INITIAL DECISION

15.2.2 Add the following to the end of Subparagraph 15.2.2:

“Contractor’s claim for extension of time shall be evaluated as follows:

.1 Contractor’s claim for delay which occurs prior to completion of footings shall be evaluated at the completion of footings.

.2 Contractor’s claim for delay which occurs after completion of footings and prior to the building being enclosed shall be evaluated after the building is enclosed. The term “enclosed” is defined to mean when the Work is sufficiently closed in (exterior walls up and roof system in place) so as to permit any structure, or major portion thereof which is part of the Work, to be adequately conditioned to allow the various trades to perform their work.

.3 Contractor's claim for delay which occurs after the building is enclosed and prior to Substantial Completion shall be evaluated at Substantial Completion.

15.3.2 Delete the last sentence, "If an arbitration is stayed"

15.4 - ARBITRATION

Delete this section in its entirety and replace with the following:

15.4 ARBITRATION AND LITIGATION

15.4.1 Binding arbitration shall not be an acceptable means of resolving claims, disputes and other matters and questions related to the Project. Any suit or legal action between Owner and Contractor related in any way to the Project shall be instituted and maintained in the Circuit Court of the jurisdiction of the project site. Enforcement of the forum selection provision may be by any legal means necessary to secure compliance, including but not limited to injunctive relief. Should any suit or action be instituted and maintained other than in such Circuit Court, the breaching party shall pay all costs, expenses and damages, including attorneys' fees and professional fees, related to such breach.

Add ARTICLE 16 as follows:

ARTICLE 16 - ENGINEERING AND LAYOUT

16.1 - VERIFICATION:

16.1.1: Except as otherwise provided, the Contractor shall furnish competent engineering services to execute the work in accordance with the contract requirements. He shall verify the figures or existing improvements shown on the drawings before undertaking any construction work and shall be responsible for the accuracy of the finished work.

16.1.2: The Owner has established, or will establish, such general reference points as will, in his judgment, enable the Contractor to proceed with the work. If the Contractor finds that any previously established reference points have been inaccurately indicated, he shall promptly notify the Architect.

16.1.3: The Contractor shall protect and preserve the established bench marks and monuments and shall make no changes in locations without the written approval of the Architect. Any such bench marks and documents that may be lost or destroyed or which require shifting because of necessary changes in grades or locations shall be replaced and accurately located by the Contractor subject to prior approval by the Architect.

Add ARTICLE 17 as follows:

ARTICLE 17 - DOCUMENT EXPLANATION AND INSTRUCTIONS

17.1 - DETAIL DRAWINGS AND INSTRUCTIONS:

17.1.1: The drawings are intended to give the general character and scope of the work.

17.1.2: In case of conflict between small and large scale drawings, the large scale drawings shall govern. Where a portion of the work is detailed or drawn out and the remainder is indicated in outline, the parts detailed or drawn out shall apply also to all other like portions of the work. Unless noted otherwise where the word "similar" occurs on the drawings, it shall be interpreted in its general sense and not as meaning "identical" and all details shall be worked out in relation to their location and connection with other parts of the work.

17.2 - MEASUREMENTS AND DIMENSIONS

17.2.1: Before ordering any materials or doing any work, each subcontractor shall verify all measurements at the building and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the drawings. Where figures are given on the drawings, said figures shall be followed in preference to measurements obtained by scale.

17.3 - SPECIFICATIONS EXPLANATION

17.3.1: The Specifications have been partially "stream-lined" and some words and phrases have been intentionally omitted. Missing portions shall be supplied by inference as with notes on drawings.

17.3.2: The words "approved", "inspected", "directed", "selected", and similar words and phrases shall be presumed to be followed by "by the Architect". The words "satisfactory", "submitted", "reported", and similar words or phrases shall be presumed to be followed by "to Architect". Words like "install", "provide", "furnish", and "supply" shall be construed to include complete furnishing and installing or constructing unless modified by additional information. Instructions, directions, and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

17.3.3: The following shall apply to and be made a part of each division of the Specifications:

- .1 General - Separation of the specifications into Division and Sections is for convenience only and is not intended to establish limits of work. It shall be the Contractor's responsibility to consult the Index to be certain that the set of Documents is complete.

17.4 - STANDARDS

17.4.1: Reference to standards, codes, specifications, recommendations and regulations refer to the latest edition or printing prior to the date and issuance of the Specifications.

17.4.2: Applicable portions of standards listed that are not in conflict with Contract Documents are hereby made a part of the Specifications. Modifications or exceptions to standards shall be considered as amendments, and unmodified portions shall remain in full effect. In cases of discrepancies between the specifications and standards listed, the requirements of the specifications shall govern. In cases of discrepancies between standards, the most stringent requirements will govern.

17.6 - MANUFACTURER'S DIRECTIONS

17.6.1: Apply, install, connect, erect, clean, and condition manufactured items or materials according to the recommendations of the manufacturer when such recommendations are not in conflict with the Contract Documents. Furnish copies of manufacturer's recommendations to Architect, on request, before proceeding with the work.

17.7 - MATERIALS AND EQUIPMENT LIST

17.7.1: Within thirty (30) days after date of award of the Contract, the Contractor shall submit for approval two (2) copies of a complete list of materials and equipment proposed for use in connection with the project. Partial lists from time to time will not be considered. In the event these requirements are not complied with, the Architect reserves the right to assume that there will be no change in materials and equipment from those specified.

17.7.2: After any material or piece of equipment has been approved, no change in brand or make will be considered unless satisfactory evidence is presented by the manufacturer stating that the material or equipment no longer is available or delivered material has been rejected, and the substitution of a suitable material is urgent or that other conditions have become apparent which indicate that approval of such other materials is in the best interest of the Owner.

17.8.- GENERAL SCOPE OF THE WORK

17.8.1: See A.I.A. General Conditions Article 1.2.

17.8.2: See A.I.A. General Conditions Article 3.4.

17.8.3: Scope: The work of each division includes the work required by each Specification division and Section heading unless specifically noted otherwise under "Related Work Specified Elsewhere".

17.8.4: Related Work Specified Elsewhere: General Conditions, Supplements to General Conditions, Special Conditions, and Temporary Work are specified elsewhere; however, these provisions of the Contract Documents are a part of and applicable to each Division and Section of the Specifications.

17.9 - DELIVERY AND STORAGE

17.9.1: Deliveries and unloading shall be timed to prevent traffic congestion and blocking of access and scheduled to avoid interferences and delays in work. Provide for continuity of supply to avoid change of supplier of materials during any phase of the work. Sufficient quantities for completion of a phase shall be on site before that phase is started.

17.9.2: Materials shall be packaged and handled to prevent damage during delivery, and stored at designated locations to avoid interference with work. Arrange materials in order of intended use. Prevent damage to stored materials with suitable sheds or coverings.

17.9.3: Storage of equipment and materials shall be limited to those exterior spaces indicated as being within the construction limits.

Add ARTICLE 18 as follows:

18.1 - CONTRACTS AND WORK LET SEPARATELY

18.1.1: Equipment Contractors shall furnish to the General Contractor all parts, supports, assemblies, etc., that are to be built into the structure as the work progresses for installation by the General Contractor and the General Contractor shall include the installation of these built-in items as part of his work. Equipment Contractors shall also furnish complete rough-in drawings.

18.1.2: The General Contractor in conjunction with the Equipment Contractor shall set up a delivery schedule of all items of equipment, allowing ample time to properly coordinate and expedite the delivery of all equipment items so as not to delay any portion of the work.

Add ARTICLE 19 as follows:

ARTICLE 19 - MAINTENANCE

19.1: The Contractor shall maintain the work from beginning of construction operations until final acceptance of the project. Maintenance shall constitute continuous and effective work prosecuted day by day with adequate equipment and forces to the end that the work is kept in satisfactory conditions at all times.

Add ARTICLE 20 as follows:

ARTICLE 20 – ARCHITECT'S ADDITIONAL SERVICES

20.1 The following provisions shall be enforced by the Architect on this project in order to be adequately compensated for additional services required due to performance issues by the Contractor and Subcontractors. In each case listed below, the Architect shall charge the Owner for all costs and time spent (at prevailing hourly rates). Such costs shall include, but not be limited to, expenses for labor, transportation and associated per diem costs. Charges shall then be deducted from subsequent payments to the Contractor. For services provided after final payment has been made to the Contractor, the Contractor hereby agrees to be invoiced directly by the Architect for all charges, and to pay such invoices within 30 days:

20.2 Review of any submittal beyond two reviews by the Architect or his consultants. (The third review of any submittal item constitutes additional services.)

20.3 Review of any submittal for work or materials that have already been ordered, delivered, installed or otherwise committed for use on the Project.

20.4 Additional site visits required during construction made necessary by the fault or neglect of the Contractor.

20.5 Re-inspection by Architect or his consultants due to failure of the Work to comply with claims of status of completion made by the Contractor.

20.6 Re-inspection and/or re-testing by Geotechnical Engineer or other consultant of the Owner due to failure of the Work to comply with claims of status of completion made by the Contractor.

20.7 Inspection by the Architect or his consultants during the warranty period as a result of defective work that did not comply with the contract documents.

Add ARTICLE 21 as follows:

ARTICLE 21 - PROHIBITION OF EMPLOYMENT DISCRIMINATION

21.1 NON-DISCRIMINATION AGREEMENT

21.1.1 During the performance of this Contract, the Contractor agrees as follows:

.1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin, except where religion, sex or national origin is a bonafide 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.

.2 The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor is an equal opportunity employer.

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

21.1.2 The Contractor will include the provisions of the foregoing paragraphs 1, 2 and 3 in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontract or vendor.

Add ARTICLE 22 as follows:

ARTICLE 22 - EMPLOYMENT OF UNAUTHORIZED ALIENS

22.1 In accordance with Section 2.2-4311.1 of the Code of Virginia (effective July 1, 2008), the Contractor does not and shall not during the performance of the contract knowingly employ an unauthorized alien as defined in the Federal Immigration Reform and Control Act of 1986.

Add ARTICLE 23 as follows:

ARTICLE 23 – CERTIFICATION REQUIRED

23.1: Code of Virginia Section 22.1-296.1(C) requires Contractors and any employee who will have direct contact with students (defined as “in the presence of students during school hours or during school sponsored activities”) to certify that the Contractor and any employees 1) have not been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child and 2) that the Contractor and any employee who will have direct contact with students has not been convicted of a crime or moral turpitude (lying or stealing). The Contractor shall cooperate and assist the school division in obtaining the necessary certifications on forms to be provided by the school division from the Contractor as well as subcontractors who will work on-site.

END OF SUPPLEMENTARY GENERAL CONDITIONS

SECTION 011000
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished/Contractor-installed (OFCL) products.
4. Contractor's use of site and premises.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and Drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.3 PROJECT INFORMATION

A. Project Identification: Bedford County Sheriff's Office Expansion.

1. Project Location: Falling Creek Road, Bedford, VA 24523. Tax Map # 147-A-40

B. Owner: Bedford County.

1. Owner's Representative: Doug Coffman.

C. Architect: Spectrum Design PC.

1. Architect's Representative: Jackie Mayrosh, PE.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Construct a new 37,290 SF office building for the Department of Social Services housing office and training/assembly spaces and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. High Density Mobile Shelving System: Relocate existing system or provide new system with equivalent storage and capabilities.

1. Owner's Existing High Density Mobile Shelving System.
 - a. Manufacturer: TAB Mobile Systems. Model number is unknown.
 - b. Location: Burks Scott Building, 119 E Main St, Bedford VA 24523.
 - c. Contractor to verify all characteristics of the existing storage system for relocation of the existing system or coordination with the new system.
2. Owner will provide access to the Existing High Density Mobile Shelving system for examination.
3. Contractor's Responsibilities: The Work includes the following, as applicable:
 - a. Contractor is responsible for providing a fully functional High Density Mobile Shelving System equivalent to the existing system.
 - b. Coordinate installation with new finishes.
 - c. Relocation:
 - 1) Contractor shall inspect shelving system prior to relocation and provide Owner with a report of any existing damage prior to relocation.
 - 2) Contractor shall provide new parts and components, including track and flooring system, if existing can not be relocated.
4. Schedule of Relocation:
 - a. If the system is being relocated, coordinate dates that the system will be removed from the existing location with the Owner. Provide a minimum of 14 days' notice.
 - b. Relocation must occur at the end of the Construction Schedule immediately prior to Substantial Completion.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by

Owner's right to perform work or to retain other contractors on portions of Project.

1.7 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
 - 1. Weekend Hours: As approved by Owner.
 - 2. Early Morning Hours: As approved by Owner.
- C. Smoking and Controlled Substance Restrictions: Use of tobacco products , alcoholic beverages, and other controlled substances on Owner's property is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated into 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.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsuitable soil and replacement with satisfactory soil material.
 - 1. Description: Unsuitable soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312323 "Backfilling."
 - 2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
 - 3. Quantity Allowance: As indicated on the bid form. Final amount shall be adjusted upward or downward based on actual quantity authorized.
- B. Unit Price No. 2: Mass rock excavation and replacement with satisfactory soil material.
 - 1. Description: Classified mass rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312318 "Rock Removal."
 - 2. Unit of Measurement: cubic yard of rock excavated, based on in-place surveys of volume before and after removal.
 - 3. Quantity Allowance: As indicated on the bid form. Final amount shall be adjusted upward or downward based on actual quantity authorized.
- C. Unit Price No. 3: Trench rock excavation and replacement with satisfactory soil material.
 - 1. Description: Classified trench rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312318 "Rock Removal."
 - 2. Unit of Measurement: cubic yard of rock excavated, based on survey of in-place surveys volume of before and after removal.
- D.

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of This Section Includes: Administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. Section 012100 "Allowances" for products selected under an allowance.
 - 3.
 - 4. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with

those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided for compliance with LEED requirements.
 - c. Requested substitution provides sustainable design characteristics that specified product provided for compliance with IgCC/ASHRAE 189.1 requirements.
 - d. Requested substitution provides sustainable design characteristics that specified product provided for compliance with Green Globes requirements.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals from authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience:
 - 1. Not allowed.
 - 2. Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
 - a. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record

noncompliance with these requirements:

- 1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
- 2) Requested substitution does not require extensive revisions to the Contract Documents.
- 3) Requested substitution is consistent with the Contract Documents and will produce indicated results.
- 4) Requested substitution provides sustainable design characteristics that specified product provided for compliance with LEED requirements.
- 5) Substitution request is fully documented and properly submitted.
- 6) Requested substitution will not adversely affect Contractor's construction schedule.
- 7) Requested substitution has received necessary approvals from authorities having jurisdiction.
- 8) Requested substitution is compatible with other portions of the Work.
- 9) Requested substitution has been coordinated with other portions of the Work.
- 10) Requested substitution provides specified warranty.
- 11) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 .

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 7 after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to Architect .
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect .
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Proposal Request Form: Use form acceptable to Architect .

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 .

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 . Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.

- e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 5. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
 6. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 7. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 27 of

the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect or 2 days prior to the second bi-monthly Owner-Architect-Contractor meeting.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit one pdf signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. When an application shows completion of an item, submit conditional final or full waivers.
 2. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final liquidated damages settlement statement.
10. Proof that taxes, fees, and similar obligations are paid.
11. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list

of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and in prominent location in built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information

or interpretation and the following:

1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect .
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log . Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect .
 - 4. RFI number, including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
 - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
 - 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 - 3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
 - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
 - 4. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 - 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 14 days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Working hours.
 - q. Owner's occupancy requirements.

- r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. Security.
 - z. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements,

- including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at twice monthly intervals.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Material location reports.
 - 5. Site condition reports.
 - 6. Unusual event reports.
- B. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.

1.2 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 Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.
- C. Critical Path: The longest connected chain of interdependent 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 time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely

- 3. affecting the early start of the successor activity.
Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Daily Construction Reports: Submit at monthly intervals.
- E. Material Location Reports: Submit at monthly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.
- G. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Regulatory agency approvals.
 - d. Punch list.
 3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Uninterruptible services.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion .
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.

5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Final Completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 1. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.
 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.7 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.

- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 2. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and Final Completion.
 - l. Activities occurring following Final Completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates to be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate

the effect of the proposed change on the overall Project schedule.

- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.8 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.

4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List to be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit 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. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013233
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
 - 4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Photos to be available to Owner/Architect by uploading to web based Project Management software site or by providing digital images at request.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect .
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.

1.3 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels . Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

- C. File Names: Name media files with date and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
- B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Flag **excavation areas** and **construction limits** before taking construction photographs.
 - 2. Take **20** photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- D. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Format: Arrange the following information in a tabular format:
 - a. Specification Section number and title.
 - b. Submittal Category: Action; informational.
 - c. Name of subcontractor.
 - d. Description of the Work covered.
 - e. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Construction Manager.
 5. Name of Contractor.
 6. Name of firm or entity that prepared submittal.
 7. Names of subcontractor, manufacturer, and supplier.
 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 9. Category and type of submittal.
 10. Submittal purpose and description.
 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 12. Drawing number and detail references, as appropriate.
 13. Indication of full or partial submittal.
 14. Location(s) where product is to be installed, as appropriate.
 15. Other necessary identification.
 16. Remarks.
 17. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data .
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the

following information, as applicable:

- a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

- E. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- F. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- G. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect .
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required , and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action .
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not

Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as as indicated in-place portions of permanent construction, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
 - a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
 2. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.3 DELEGATED DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the

products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: 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.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.

5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 ACTION SUBMITTALS

A. Mockup Shop Drawings: For integrated exterior mockups.

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. 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.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- 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 of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 - 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- J. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
 - 1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure

the work.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspection will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- 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 as specified in Section 013300 "Submittal Procedures."
- E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control

services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner , as indicated in the Statement of Special Inspections attached to this Section, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected Work.
 - 7.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's and authorities' having jurisdiction reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION



TOWN OF BEDFORD
OFFICE OF BUILDING INSPECTIONS
215 East Main St. (540) 587-6024
www.bedfordva.gov gmciver@bedfordva.gov

STATEMENT OF SPECIAL INSPECTIONS
Pursuant with VUSBC 111.2 and Chapter 17 of the VCC

Project Name: Bedford County Department of Social Services

Project Address: Falling Creek Rd. Bedford, VA 24523

Permit Number: _____ **General Contractor:** _____

Registered Design Professional In Charge:

Name: Ronald Rodkey **Firm:** Spectrum Design, PC

Special Inspections Engineer in Charge:

Name: _____ **Firm:** _____

Inspections and Testing (check and complet all applicable):

☒ **Concrete**

Agency or Individual: _____ **Phone:** _____

Address: _____

☒ **Steel**

Agency or Individual: _____ **Phone:** _____

Address: _____

☒ **Masonry**

Agency or Individual: _____ **Phone:** _____

Address: _____

☐ **Other**

Agency or Individual: _____ **Phone:** _____

Address: _____

Submitted by:

Printed Name: Jacqueline Mayrosh, PE **E-Mail:** jmayrosh@spectrumpc.com

Signature: Jacqueline Mayrosh **Date:** June 1, 2026

SECTION 014200 REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).

21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; [**American Society of Mechanical Engineers (The)**]; www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWWA - American Water Works Association; www.awwa.org.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BSI - British Standards Institution; www.bsigroup.com.
50. BWF - Badminton World Federation; www.bwfbadminton.com.
51. CARB - California Air Resources Board; www.arb.ca.gov.
52. CDA - Copper Development Association Inc.; www.copper.org.
53. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
54. CEA - Canadian Electricity Association; www.electricity.ca.
55. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
56. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
57. CGA - Compressed Gas Association; www.cganet.com.
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.

61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CMHA - Concrete Masonry & Hardscape Association; (Formerly: National Concrete Masonry Association); www.masonryandhardscapes.org.
63. CPA - Composite Panel Association; www.compositepanel.org.
64. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
65. CRRC - Cool Roof Rating Council; www.coolroofs.org.
66. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
67. CSA - CSA Group; www.csagroup.org.
68. CSI - Cast Stone Institute; www.caststone.org.
69. CSI - Construction Specifications Institute (The); www.csiresources.org.
70. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
71. CTA - Consumer Technology Association; www.cta.tech.
72. CTI - Cooling Technology Institute; www.coolingtechnology.org.
73. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
74. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
75. DHI - Door and Hardware Institute; www.dhi.org.
76. ECIA - Electronic Components Industry Association; www.ecianow.org.
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
80. ESTA - Entertainment Services and Technology Association; www.esta.org.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FGIA - Fenestration and Glazing Industry Alliance; <https://fgiaonline.org>.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
87. FM Global - FM Global; www.fmglobal.com.
88. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridarroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
95. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
96. IAS - International Accreditation Service; www.iasonline.org.
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
99. ICPA - International Cast Polymer Association (The); www.theicpa.com.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE SA - IEEE Standards Association; <https://standards.ieee.org>.
103. IES - Illuminating Engineering Society; www.ies.org.
104. IEST - Institute of Environmental Sciences and Technology; www.iest.org.

105. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
106. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
107. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
108. Intertek - Intertek Group; www.intertek.com.
109. ISA - International Society of Automation (The); www.isa.org.
110. ISFA - International Surface Fabricators Association; www.isfanow.org.
111. ISO - International Organization for Standardization; www.iso.org.
112. ITU - International Telecommunication Union; www.itu.int.
113. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
114. LPI - Lightning Protection Institute; www.lightning.org.
115. MBMA - Metal Building Manufacturers Association; www.mbma.com.
116. MCA - Metal Construction Association; www.metalconstruction.org.
117. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
118. MFMA - Metal Framing Manufacturers Association, Inc.;
www.metalframingmfg.org.
119. MHI - Material Handling Industry; www.mhi.org.
120. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
121. MPI - Master Painters Institute; www.paintinfo.com.
122. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
123. NAAMM - National Association of Architectural Metal Manufacturers;
www.naamm.org.
124. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
125. NADCA - National Air Duct Cleaners Association; www.nadca.com.
126. NAIMA - North American Insulation Manufacturers Association;
www.insulationinstitute.org.
127. NALP - National Association of Landscape Professionals;
www.landscapeprofessionals.org.
128. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
129. NBI - New Buildings Institute; www.newbuildings.org.
130. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
131. NCMA - National Concrete Masonry Association; (see CMHA).
132. NEBB - National Environmental Balancing Bureau; www.nebb.org.
133. NECA - National Electrical Contractors Association; www.necanet.org.
134. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
135. NEMA - National Electrical Manufacturers Association; www.nema.org.
136. NETA - InterNational Electrical Testing Association; www.netaworld.org.
137. NFHS - National Federation of State High School Associations; www.nfhs.org.
138. NFPA - National Fire Protection Association; www.nfpa.org.
139. NFPA - NFPA International; (see NFPA).
140. NFRC - National Fenestration Rating Council; www.nfrc.org.
141. NGA - National Glass Association; www.glass.org.
142. NHLA - National Hardwood Lumber Association; www.nhla.com.
143. NLGA - National Lumber Grades Authority; www.nlga.org.
144. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
145. NOMMA - National Ornamental & Miscellaneous Metals Association;
www.nomma.org.
146. NRCA - National Roofing Contractors Association; www.nrca.net.
147. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
148. NSF - NSF International; www.nsf.org.

149. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
150. NSPE - National Society of Professional Engineers; www.nspe.org.
151. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
152. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
153. NWFA - National Wood Flooring Association; www.nwfa.org.
154. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.
157. PLASA - PLASA; www.plasa.org.
158. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
159. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
160. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
161. RFCI - Resilient Floor Covering Institute; www.rfci.com.
162. RIS - Redwood Inspection Service; (see WWPA).
163. SAE - SAE International; www.sae.org.
164. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
165. SDI - Steel Deck Institute; www.sdi.org.
166. SDI - Steel Door Institute; www.steeldoor.org.
167. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
168. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
169. SIA - Security Industry Association; www.securityindustry.org.
170. SJI - Steel Joist Institute; www.steeljoist.org.
171. SMA - Screen Manufacturers Association; www.smainfo.org.
172. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
173. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
174. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
175. SPIB - Southern Pine Inspection Bureau; www.spib.org.
176. SPRI - Single Ply Roofing Industry; www.spri.org.
177. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
178. SSINA - Specialty Steel Industry of North America; www.ssina.com.
179. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
180. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
181. SWI - Steel Window Institute; www.steelwindows.com.
182. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
183. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
184. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
185. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
186. TIA - Telecommunications Industry Association; www.tiaonline.org.
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Industry Alliance; www.tilerroofing.org.
191. ULSE - UL Standards & Engagement Inc.; www.ulse.org.
192. UL - UL Solutions Inc.; www.ul.com.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.

195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WA - Wallcoverings Association; www.wallcoverings.org.
197. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.
200. WI - Woodwork Institute; www.woodworkinstitute.com.
201. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
202. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov.
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of

the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from U.S. General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
6. MILSPEC - Military Specifications and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; <https://tfsweb.tamu.edu/>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70 and requirements of the local utility company.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC A117.1.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
 - 1. GC to coordinate location with owner.
 - 2. Provide up to 600 linear feet.

2.2 TEMPORARY FACILITIES

- A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
1. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 2. Drinking water and private toilet.
 3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service:

1. Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service:

1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Install electric power service underground unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under

conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 321216 "Asphalt Pavement."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Designate area on-site for parking areas for construction personnel.
- F. Storage and Staging: Use areas of Project site for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
 - 3. Ponding water will not be allowed.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

- a. Provide temporary, directional signs for construction personnel and visitors.
- 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities:
 - 1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
 - 2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control:
 - 1. Comply with authorities having jurisdiction and requirements specified in Section 311000 "Site Clearing."
 - 2. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with Section 312513 Erosion Control.
 - a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.

- b. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - d. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion in accordance with Section 313116 Termite Control. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering limits of disturbance except by entrance gates.
 - 1. Extent of Fence: Coordinate with Owner
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking

- specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative

humidity, and exposure to water limits.

- a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
- b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
- c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. 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 temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 012100 "Allowances" for products selected under an allowance.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 014200 "References" for applicable industry standards for products specified.
 - 5. Section 017700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluating Comparable Products: In addition to the basis-of-design product

description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

- a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 7. Protect stored products from damage and liquids from freezing.
 8. Provide a secure location and enclosure at Project site for storage of materials

and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or

equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

- a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the

product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - 1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp or Indication of approval in web-based Project management software. See Section 013300 "Submittal Procedures."
- C. Submittal Requirements, Single-Step Process: When acceptable to Architect,

incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering.
 - 3. Installation.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for coordination of , and limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 078413 "Through-Penetration Firestop Systems" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor professional engineer.
- B. Certified Surveys: Submit one digital pdf copy signed by land surveyor.
- C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit one digital copy showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.

- c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other

construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect .

3.4 FIELD ENGINEERING

- A. Identification: Identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb, and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products

to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures

with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary

through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be

repaired without visible evidence of repair.

- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final Completion procedures.
 - 3. List of incomplete items.
 - 4. Submittal of Project warranties.
 - 5. Final cleaning.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
 - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of

products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."

6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
 - 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 - 4. Submit list of incomplete items in the following format:
 - a. MS Excel Electronic File: Architect will return annotated file.
 - b. PDF Electronic File: Architect will return annotated file.
 - c. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf

- binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils.
- 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
- q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general

scope and content of manual are acceptable.

- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within Insert number days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and

- major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents

alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation in accordance with ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.

- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.

7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- 1.10 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are

issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file .
 3. Record Digital Data Files: Organize digital data information into separate

electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect .
 - e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 3. Note related Change Orders and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file.
 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for

miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:

- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

- B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 031000
CONCRETE FORMING 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. Form-facing material for cast-in-place concrete.
 - 2. Form liners.
 - 3. Shoring, bracing, and anchoring.
- B. Related Requirements:

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following:

1. Exposed surface form-facing material.
 2. Form liners.
 3. Form-release agent.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
 - a. Location of construction joints is subject to approval of the Architect.
 3. Indicate location of waterstops.
 4. Indicate form liner layout and form line termination details.
- C. Samples:
1. For waterstops.
 2. For Form Liners: 12-inch by 12-inch sample, indicating texture.

1.6 INFORMATIONAL SUBMITTALS

- A. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
1. Build panel approximately 32 sq. ft. in the location indicated or, if not indicated, as directed by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle forms in a manner to prevent damage to form surface.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations, and as follows:
 - a. Plywood, metal, or other approved panel materials.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with end forms.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.3 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.4 RELATED MATERIALS

A. 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.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- D. 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified..
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.

- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Space vertical joints in walls as indicated on Drawings.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
3. Install dowels for reinforced concrete masonry walls.
4. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, 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.
 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 1. Align and secure joints to avoid offsets.
 2. 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. 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 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. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates and Test Reports: For each of the following, signed by manufacturers:

1. Steel Reinforcement

B. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately 32 sq. ft. in the location indicated on Drawings or, if not indicated, as directed by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, 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.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped as indicated.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
- B. 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.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, finishes, and curing.

B. Related Requirements:

1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Ready-mix concrete manufacturer.
 - c. Concrete Subcontractor.
 - d. Special Inspector,
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.

- k. Methods for achieving specified floor and slab flatness and levelness.
- l. Floor and slab flatness and levelness measurements.
- m. Concrete repair procedures.
- n. Concrete protection.
- o. Initial curing of field test cylinders (ASTM C31/C31M.)

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Blended hydraulic cement.
- 4. Aggregates.
- 5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 6. Vapor retarders.
- 7. Curing and sealing compounds.
- 8. Joint fillers.
- 9. Repair materials.
- 10. Floor sealers.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Durability exposure class.
- 4. Maximum w/cm.
- 5. Slump limit.
- 6. Air content.
- 7. Nominal maximum aggregate size.
- 8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
- 9. Intended placement method.
- 10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

- 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Preconstruction Test Reports: For each mix design.

D. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Formed Surfaces: Build panel approximately 32 sq. ft. Insert area in the location indicated or, if not indicated, as directed by Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. 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 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
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 ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Water: Potable or complying with ASTM C1602/C1602M.
- C. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
- D. Do not use curing compounds at locations to receive resinous flooring. Refer to Finish Schedule.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 ONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent by mass for footings and walls, 15 percent by mass for slabs.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, piers, and walls.
 - 1. Exposure Class: ACI 318 F0, S0, W0, C0.
 - 2. Minimum Compressive Strength: 4000 psi at 28 days.
 - 3. Maximum w/cm: 0.50.
 - 4. Slump Limit: 4 inches , plus or minus 1 inch.
 - 5. Air Content: No air-entraining admixture required.
 - 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- B. Class A: Normal-weight concrete used for walls and beams.

1. Exposure Class: ACI 318 F1, S0, W0, C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
 4. Slump Limit: 4 inches , plus or minus 1 inch.
 5. Air Content: No air-entraining admixture required.
 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- C. Class C: Normal-weight concrete used for interior slabs-on-grade and slabs on steel deck.
1. Exposure Class: ACI 318 F0, S0, W0, C0.
 2. Minimum Compressive Strength: 4000 psi at 28 days.
 3. Maximum w/cm: 0.50.
 4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
 5. Slump Limit: 5 inches plus or minus 1 inch, 8 inches plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
 6. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- D. Class D: Normal-weight concrete used for exterior concrete walls, piers and slabs-on-grade.
1. Exposure Class: ACI 318 F2, S0, W1, C1.
 2. Minimum Compressive Strength: 4500 psi at 28 days.
 3. Maximum w/cm: 0.45.
 4. Slump Limit: 5 inches , plus or minus 1 inch.
 5. Air Content:
 - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete.
 6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 1. Daily access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap joints 6 inches and seal with manufacturer's recommended tape.
 4. Terminate vapor retarder at the top of floor slabs, sealing entire perimeter to existing floor slabs and foundation walls.
 5. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 6. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 4. Space vertical joints in walls as indicated on Drawings.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form control 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 cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- 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. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 - 1. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.

- b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: Apply to exposed concrete surfaces.
- B. Rubbed Finish: Apply the one of the following to exposed wall, beam, and column surfaces. Finish shall be consistent throughout the Project.
 - 1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
 - d. Maintain required patterns or variances to match approved mockups.
 - 2. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. 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.
 - f. Maintain required patterns or variances to match approved mockups.
- C. Related Unformed Surfaces:
 - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
 - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.

2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Do not add water to concrete surface.
4. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
5. Apply a trowel finish to surfaces to vault base slab, slabs-on-grade, and vault suspended slab.
6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs-on-Ground:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.
 - b. Suspended Slabs:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

D. Broom Finish: Apply a broom finish to exterior concrete flat work.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
4. Curing: Comply with ACI 308.1.

B. Curing Slab-on-Grade Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Apply two coats of curing and sealing compound in accordance with manufacturer's written instructions.

3.11 TOLERANCES

- A. Conform to ACI 117.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged the minimum time period specified by the joint filler manufacturer or at least one month, whichever is greater.
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
 2. 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.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. 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.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including 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.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 - b. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - c. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with 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.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

- c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
- 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. 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.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M:

- a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
 - a. 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. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure five 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one laboratory-cured specimens at seven days.
 - b. Test three laboratory-cured specimens at 28 days.
 - c. Hold one laboratory-cured specimen to test at 56 days if required.
 - d. A compressive-strength test to be the average compressive strength from a set of three specimens obtained from same composite sample and tested at 28 days.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. 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.
9. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 034813
PRECAST CONCRETE BOLLARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast concrete bollards.
 - 2. Accessories
- B. Related Requirements:

1.2 REFERENCE STANDARDS

- A. ASTM C666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- B. ASTM C825 - Standard Specification for Precast Concrete Barriers.
- C. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.

1.3 SUBMITTALS

- A. Comply with Section 013300 Submittal Procedures.
- B. Product Data: Provide for each type of bollard specified.
- C. Color Samples: Submit manufacturer's standard colors for selection
- D. Maintenance Data: Submit manufacturer's field touch-up, cleaning, and maintenance instructions.
- E. Warranty Documentation: Submit sample of manufacturer's warranty.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect bollards and accessories during delivery, storage, and handling.

1.5 WARRANTY

- A. Provide manufacturer's standard warranty against defects in materials and workmanship.
 - 1. Warranty Period: Five years from date of invoice.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belson Outdoors
 - 2. Reliance Foundry Co. Ltd.
 - 3. Post Guard

2.2 PRECAST CONCRETE BOLLARDS

- A. Material:
 - 1. Concrete: Precast concrete with 5200-psi (36 MPa) minimum compressive strength.
 - a. Components: ASTM C150, Type I or III cement, with ASTM C33 aggregate.
 - b. Pigments: ASTM C979, natural mineral oxide pigments, temperature-stable and non-fading.
 - 2. Reinforcing: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
 - 3. Steel Pipe: ASTM A 500, Grade B.
- B. Installation: Steel Pipe Anchor.
- C. Precast Concrete Bollard:
 - 1. Basis of design: Belson Outdoors Model TF6020
 - 2. Color: Selected by Architect from manufacturer's standard range.
 - 3. Finish: Acid Wash

2.3 ACCESSORIES

- A. Installation Materials:
 - 1. Grout: Non-shrink, non-ferrous grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine paving or other substrates for compliance with manufacturer's requirements for placement and location of embedded items, condition of substrate, and other conditions affecting installation of bollards.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's installation instructions and setting drawings.

- B. Do not install damaged, cracked, chipped, deformed, or marred bollards. Field touch-up minor imperfections in accordance with manufacturer's instructions. Replace bollards that cannot be field repaired.
- C. Direct Imbed: Support bollard during concrete placement and cure.

3.3 CLEANING & PROTECTION

- A. Protect bollards against damage.
- B. Immediately prior to Substantial Completion, clean bollards in accordance with manufacturer's instructions to remove dust, dirt, adhesives, and other foreign materials.
- C. Touch up damaged finishes according to manufacturer's instructions.

3.4 CLOSEOUT ACTIVITIES

- A. Provide executed warranty.

END OF SECTION

SECTION 042000
UNIT MASONRY

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 REFERENCES

- A. ACI 530 – Building Code for Masonry Structures.
- B. BIA (Brick Institute of America) Technical Notes.

1.3 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Face brick.
 - 3. Mortar and grout.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Dovetail slots for masonry anchors, installed under Division 3 Section "Cast-in-Place Concrete."
 - 2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."
 - 2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
- D. Allowances: See brick allowances as specified in Division 1 Section "Allowances".

1.4 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops a net-area compressive strength (f'_m) of 2000 psi at 28 days.
- B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- C. Samples for Initial Selection: For the following:
 - 1. Face brick, in the form of straps of five or more bricks.
 - 2. Colored mortar.
- D. 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 the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
 - d. For surface-coated brick, include material test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
 - e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Joint reinforcement.
 6. Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
 2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
 4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
1. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
 2. Protect approved sample panels from the elements with weather-resistant membrane.
 3. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- G. 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 typical wall area as shown on Drawings.
 2. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
 - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - c. Include studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
 3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface and where exposed to sunlight.
 4. Clean exposed faces of mockups with masonry cleaner as indicated.
 5. Protect accepted mockups from the elements with weather-resistant membrane.
 6. 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; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. 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.
 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.8 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.
- 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 designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 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 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold 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 in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners, unless otherwise indicated.
- B. Concrete Masonry Units: ASTM C 90.
1. Weight Classification: Lightweight, unless otherwise indicated.
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 CONCRETE AND MASONRY LINTELS

- A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 3 Section "Cast-in-Place Concrete."
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

- A. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: ASTM C 216, Grade SW, Type FBS.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 - 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
 - 5. Modular size; Actual Dimensions approximately 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - 6. Application: Use where brick is exposed, unless otherwise indicated.

7. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
8. Bond Pattern: Running bond, unless otherwise noted on Drawings.
9. Face Brick Types:
 - a. Face Brick Type 1 (Basis of Design):
 - 1) Manufacturer: Glen-Gery
 - 2) Product: 53-DD
 - 3) Texture/Color: As Manufactured
 - 4) Size: Modular
 - 5) Use Location: As indicated on Drawings
 - 6) Mortar Color: Provide mortar color as selected by architect from full range of mortar colors including white and natural sand color options. Note that different mortar colors may be used for each face brick type.
 - b. Face Brick Type 2 (Basis of Design):
 - 1) Manufacturer: Glen-Gery
 - 2) Product: Castile Gray
 - 3) Texture/Color: As Manufactured
 - 4) Size: Modular
 - 6) 5) Use Location: As indicated on Drawings Mortar Color: Provide mortar color as selected by architect from full range of mortar colors including white and natural sand color options. Note that different mortar colors may be used for each face brick type.
10. Available Products:
 - a. See allowances section for further descriptions

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. 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 C 207, Type S.
- D. Masonry Cement: ASTM C 91.
 1. Available Products:
 - a. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - b. Essroc, Italcementi Group; Brixment or Velvet.
 - c. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.
 - d. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Florida Super Masonry Trinity Super White Masonry Type S Trinity White Masonry Type N.

- e. Lehigh Cement Company; Lehigh Masonry Cement Lehigh White Masonry Cement.
 - f. National Cement Company, Inc.; Coosa Masonry Cement.
- E. Mortar Cement: ASTM C 1329.
 - 1. Available Products:
 - a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
- F. 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.
 - 1. Available Products:
 - a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- G. Colored Cement Product: Packaged blend made from portland cement and lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 2. Pigments shall not exceed 10 percent of portland cement by weight.
 - 3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - 4. Available Products:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond.
 - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
 - b. Colored Masonry Cement:
 - 1) Capital Materials Corporation; Flamingo Color Masonry Cement.
 - 2) Essroc, Italcementi Group; Brixment-in-Color.
 - 3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 4) Lafarge North America Inc.; Florida Custom Color Masonry or Magnolia Masonry Cement.
 - 5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
 - 6) National Cement Company, Inc.; Coosa Masonry Cement.
 - c. Colored Mortar Cement:

1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

I. Aggregate for Grout: ASTM C 404.

J. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill- Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.
2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.

2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
- B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from steel sheet, galvanized after fabrication not less than 0.053 inch thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.
- C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel wire.
- E. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch-diameter, hot-dip galvanized steel wire.
 3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch- thick, steel sheet, galvanized after fabrication.
 4. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.
- F. Partition Top anchors: 0.097-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- H. Adjustable Masonry-Veneer Anchors
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

- a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - b. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - c. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - d. Fabricate sheet metal anchor sections and other sheet metal parts from 0.097-inch- thick, steel sheet, galvanized after fabrication .
 - e. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- diameter, hot-dip galvanized steel wire.
 - f. Available Products:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
 - 2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
 - 3) Hohmann & Barnard, Inc.; DW-10 DW-10HS or DW-10-X.
 - 4) Wire-Bond; 1004, Type III.
4. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
 - a. Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch, hot-dip galvanized wire.
 - b. Strap-and-Wire Type Anchor: Flat metal strap with notch to interlock with flange of metal stud and two holes for inserting vertical legs of wire tie specially formed to fit anchor section. Strap is made from 0.067-inch- thick, steel sheet, galvanized after fabrication; anchor wire tie is made from 3/16-inch, hot-dip galvanized wire.

c. Available Products:

- 1) BLOK-LOK Limited; STUD-LOK.
- 2) Hohmann & Barnard, Inc.; AA308.

5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

a. Available Products:

- 1) ITW Buildex; Teks Maxiseal with Climaseal finish.
- 2) Textron Inc., Textron Fastening Systems; Elco Drill-Flex with Stalgard finish.

- I. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from copper, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).
- 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
- 3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.

- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

1. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - 1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
 - 2. Available Products:
 - a. Advanced Building Products Inc.; Mortar Break Mortar Break II.
 - b. Archovations, Inc.; CavClear Masonry Mat.
 - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - d. Mortar Net USA, Ltd.; Mortar Net.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 3. Limit cementitious materials in mortar for exterior masonry to portland cement and lime.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in 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 C 270 BIA Technical Notes 8A, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For mortar parge coats, use Type S.
 - 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - 3. Mix to match Architect's sample.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-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: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems."

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 36 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

- a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
1. Brick at sills and lintels shall be tied to adjacent brick, masonry, or structure according to BIA recommendations.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- D. 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-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide individual metal ties not more than 8 inches o.c.
 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 36 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.
 4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
 - C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.
 - D. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing."

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
 - 3. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
 - 4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
 - 6. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
 - 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch 1/2 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 3/8 inch .
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - 3. Space weep holes formed from wicking material 16 inches o.c.
 - 4. Trim wicking material flush with outside face of wall after mortar has set.
 - 5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
- B. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
- D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.15 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch . Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

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, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."

3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

3.18 CONCRETE PAVER INSTALLATION

- A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1½ in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.
 1. Do not disturb screeded sand.
 2. Screeded area shall not substantially exceed that which is covered by pavers in one day.
 3. Do not use bedding sand to fill depressions in the base surface.
- B. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.
- C. Provide joints between pavers between 1/16 in. and 3/16 in. (2 and 5 mm) wide. No more than 5% of the joints shall exceed 1/4 in. (6 mm) wide to achieve straight bond lines.
- D. Joint (bond) lines shall not deviate more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.
- E. Fill gaps at the edges of the paved area with cut pavers or edge units.
- F. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.
- G. Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicular tires shall be no smaller than one-third of a whole paver.
- H. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.
- I. Use a low-amplitude plate compactor capable of at least minimum of 5,000 lbf (22 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.
- J. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This requires at least 4 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.
- K. All work within 6 ft. (2 m) of the laying face shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut

and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

- L. Remove excess sand from surface when installation is complete.
- M. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by Architect.
- N. Surface shall be broom clean after removal of excess joint sand.
- O. The final surface tolerance from grade elevations shall not deviate more than $\pm 3/8$ in. (± 10 mm) under a 10 ft (3 m) straightedge.
- P. Lippage: No greater than 1/8 in. (3 mm) difference in height between adjacent pavers.

END OF SECTION

SECTION 047200
CAST STONE

PART 1 GENERAL

1.1. SECTION INCLUDES - CAST STONE.

- A. Scope - All labor, materials and equipment to provide the Cast Stone shown on architectural drawings and as described in this specification.
 - 1. Manufacturer shall furnish Cast Stone covered by this specification.
 - 2. Installing contractor shall unload, store, furnish all anchors, set, patch, and clean the Cast Stone as required.

1.2. REFERENCES

- A. ASTM C 33 – Standard Specification for Concrete Aggregates.
- B. ASTM C 150 - Standard Specification for Portland Cement.
- C. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.
- D. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
- E. ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units
- F. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.
- G. ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- H. ASTM C 1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.
- I. ASTM C 1195 - Standard Test Method for Absorption of Architectural Cast Stone.
- J. ASTM C 1364 - Standard Specification for Architectural Cast Stone.
- K. Cast Stone Institute® Technical Manual (Current Edition)

1.3. DEFINITIONS

- A. Cast Stone - a refined architectural concrete building unit manufactured to simulate the color and texture of natural cut stone, used in masonry applications.
 - 1. Dry Cast Concrete Products – manufactured from zero slump concrete.
 - a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero- slump concrete against a rigid mold until it is densely compacted.

1.4. SUBMITTAL PROCEDURES

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.
- C. Test results: Submit manufacturers test results of Cast Stone previously made by the manufacturer.
- D. Shop Drawings: Submit manufacturers shop drawings including profiles, cross sections, reinforcement, exposed faces, arrangement of joints (optional for standard or semi-custom installations), anchoring methods, anchors (if required), annotation of stone types and their location.

1.5. QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities, size and quality of Cast Stone required in accordance with the project schedule.
 - 2. Manufacturer shall be a current producer member of the Cast Stone Institute
 - 3. Manufacturer shall submit a written list of projects similar in scope and at least three (3) years of age, along with owner, architect and contractor references.
 - 4. Products previously produced by the plant and exposed to weather shall exhibit satisfactory appearance
- B. Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual, ASTM C 1364 and the project specifications. Where a conflict may occur, the contract documents shall prevail.
- C. Mock-up: Provide full size cast stone units for use in construction of sample wall. The approved mock-up shall become the standard for appearance and workmanship for the project.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Including, but not limited to:

- A. Arriscraft
- B. Oldcastle
- C. Miscellaneous Concrete Products
- D. Superior Precast Products

2.2. ARCHITECTURAL CAST STONE

- A. Comply with ASTM C 1364

- B. Casting Method: Vibrant Dry Tamp
- C. Physical properties: The Cast Stone produced must meet the following:
 - 1. Compressive Strength - ASTM C 1194: 6,500 psi minimum for products at 28 days.
 - 2. Absorption - ASTM C 1195: 6% maximum by the cold water method
 - 3. Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
 - 4. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.

2.3. RAW MATERIALS

- A. Portland cement: ASTM C 150 – Type I or Type III, white and/or grey according to what is required to match specified color.
- B. Coarse aggregates: ASTM C 33 - Limestone
- C. Fine aggregates: ASTM C 33 - Manufactured or natural sands
- D. Colors: ASTM C 1364 - Inorganic iron oxide pigments
- E. Admixtures: ASTM C 1364
- F. Water: Must be potable
- G. Reinforcing: Galvanized or epoxy coated used when required by ASTM C 1364.

2.4. COLOR AND FINISH

- A. Color Selection: Color to match “15-99” by Miscellaneous Concrete Products.
- B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in. (25 mm) and not obvious under direct daylight illumination at a 5 ft (1.5m) distance.
- C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3 m) distance.

2.5. REINFORCING

- A. Reinforcement shall be new billet steel reinforcing bars meeting the requirements of Specification A615/A615M unless specified otherwise by purchaser.
- B. Reinforce units when necessary for safe handling and structural stress.
- C. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1/5 in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.
- D. Area of reinforcement in panels greater than 24 in. (600 mm) in more than one direction shall be not less than 0.25% of the cross section area [in that direction].

Units less than 24 in. (600 mm) in both their length and width dimension shall be non-reinforced unless otherwise specified.

2.6. ACCESSORIES:

- A. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as galvanized steel, brass or stainless steel Type 302 or 304 sized appropriately for the conditions.

2.7. CURING AND FINISHING:

- A. Cure units in a warm, moist curing chamber approximately 100°F (37.8°C) at 95 percent relative humidity for approximately 24 hours. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.
- B. Acid –etch exposed surfaces to remove cement film prior to packaging. Suitable washing shall be provided for all exposed surfaces unless otherwise noted.

2.8. MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than $\pm 1/8$ in. (3 mm) from approved dimensions.
- B. Length of units shall not deviate by more than length/ 360 or $\pm 1/8$ in. (3 mm), whichever is greater, not to exceed $\pm 1/4$ in. (6 mm). o Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp, bow or twist of units shall not exceed length/ 360 or $\pm 1/8$ in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in. (3 mm), on unformed sides of unit, 3/8 in. (9 mm) maximum deviation.

2.9. PRODUCTION QUALITY CONTROL

- A. Testing.
 - 1. Test compressive strength and absorption from specimens selected at random from plant production.
 - 2. Samples shall be taken and tested from every 500 (14 m³) cubic feet of product produced.
 - 3. Perform tests in accordance ASTM C 1364
 - 4. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.

PART 3 DELIVERY, STORAGE AND HANDLING

3.1. PLANT PACKAGING

- A. Mark production units with the identification marks as shown on the shop drawings.
- B. Package units and protect them from staining or damage during shipping and storage.
- C. Provide an itemized list of products.

3.2. SHIPMENT

- A. Delivery
 - 1. Cast Stone units shall be delivered secured to shipping pallets and protected from damage and discoloration.
 - 2. Each piece will be individually numbered to match shop drawings.
- B. Storage
 - 1. Store cast stone units in accordance with manufacturer's instructions
 - 2. Store cast stone units on pallets with waterproof covers.
 - 3. Prevent contact with dirt.
- C. Handling:
 - 1. Protect cast stone units during handling and installation to prevent chipping, cracking and other damage.
- D. Scheduling: Schedule and coordinate production and delivery of cast stone to optimize on-site inventory and to avoid delay of work.

3.3. EXAMINATION

- A. Installing contractor shall visual inspect Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.4. SETTING TOLERANCES

- A. Comply with Cast Stone Institute® Technical Manual.
- B. Set stones 1/8 in. (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/16 in. (1.5 mm), minus - 1/8 in. (3 mm). 3.5. Jointing A. Joint size:
 - 1. At stone/brick joints 3/8 in. (9.5 mm).
 - 2. At stone/stone joints in vertical position 1/4 in. (6 mm) (3/8 in. (9.5 mm) optional).
 - 3. Stone/stone joints exposed on top 3/8 in. (9.5 mm).

- B. Joint materials:
 - 1. Mortar, Type N, ASTM C 270.
 - 2. Use a full bed of mortar at all bed joints.
 - 3. Flush vertical joints full with mortar.
 - 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 - 5. Leave head joints in copings and projecting components open for sealant.
- C. Location of joints:
 - 1. As shown on drawings.
 - 2. At control and expansion joints unless otherwise shown.

3.6. SETTING

- A. Drench units with clean water prior to setting.
- B. Do not use any equipment in a manner that could damage the cast stone.
- C. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- D. Set units in full bed of mortar, unless otherwise detailed.
- E. Fill vertical joints with mortar.
- F. Make joints 3/8 inch (9mm) unless otherwise detailed on the drawings.
- G. Leave head joints in copings and similar components open for sealant.
- H. Rake mortar joints 3/4 in. (18 mm) in. for pointing.
- I. Remove excess mortar from unit faces immediately after setting.
- J. Tuck point unit joints to a slight concave profile.

3.7. JOINT PROTECTION

- A. Comply with requirements of Section 07 90 00.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.
- C. Provide sealant joints at locations indicated on drawings.

3.8. REPAIR AND CLEANING

- A. Repair: Repair chips or other surface damage with touchup materials furnished by manufacturer and in accordance with manufacturer's instructions.
- B. Cleaning:
 - 1. Clean exposed cast stone after mortar is thoroughly set and cured

2. Saturate units to be cleaned with water prior to applying an approved masonry cleaner.
3. Consult with manufacturer for appropriate cleaners and for cleaning instructions.
4. Remove cleaner promptly by rinsing thoroughly with clear water.

3.9. INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36.
- B. Do not field apply water repellent until repair, cleaning, inspection and acceptance is completed.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.
3. Shear stud connectors.
4. Lintels, ledgers, and shelf angles.
5. Bearing plates.
6. Architecturally Exposed Structural Steel (AESS)

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
 2. Welded built-up members with plates thicker than 2 inches.
 3. Column base plates thicker than 2 inches.

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 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.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data:
1. Structural-steel materials.

2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

B. 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.

C. Survey of existing conditions.

1.7 QUALITY ASSURANCE

A. Installer (Erector) Qualifications: The installer shall be qualified per Division 1 specifications. The installer shall maintain and implement quality control practices per the Virginia Uniform Statewide Building Code and by reference IBC Chapter 17, AISC 360-16 Chapter N, and AISC 303-16 Chapter 8. All erection work of structural steel, open-web steel joists, and steel deck shall be subject to Special Inspections.

- B. Fabricator Qualifications: The fabricator shall be qualified per Division 1 specifications. The fabricator shall maintain and implement quality control practices per the Virginia Uniform Statewide Building Code and by reference IBC Chapter 17, AISC 360-16 Chapter N, and AISC 303-16 Chapter 8. If the fabricator does not have their quality control program reviewed, audited, and certified by an independent approved agency or have AISC Building Fabricator certification, the structural steel fabrication work for the project shall be subject to inspection by the Special Inspector at the fabricator's facility. Inspections include review of welding procedures, steel material mill certifications steel material management, and fastener certifications.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles, M-Shapes: ASTM A36/A36M.
- C. Hollow Structural Sections (HSS): ASTM A500 Gr. B ($F_y = 46$ ksi).
- D. Plate and Bar: ASTM A36/A36M. ASTM A572 Gr. 50 ($F_y = 50$ ksi).
- E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.3 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
 - 1. Configuration: Hooked.
 - 2. Nuts: ASTM A563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A36/A36M carbon steel.
 - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
 - 1. Nuts: ASTM A563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- C. Threaded Rods: ASTM A36/A36M.
 - 1. Nuts: ASTM A563 heavy-hex carbon steel.
 - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 3. Finish: Plain.

2.4 PRIMER

- A. Steel Primer:
 - 1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." for structural steel exposed in the finished condition,
 - 2. Do not apply primer to structural steel receiving sprayed fire-resistive materials (applied fireproofing)..
- B. Galvanized-Steel Primer: MPI#26 MPI#80, MPI#134.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. 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 in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels shelf angles attached to structural-steel frame and located in exterior walls.

2.9 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 unless indicated to be painted.
6. Surfaces enclosed in interior construction.

- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 14 (WAB)/NACE WAB-8.
3. SSPC-SP 11.

- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 - 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.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: Snug tightened.
 - 2. Provide fully-tensioned bolts for moment connections and bolts subject to direct or prying tension.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 - 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.

- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

END OF SECTION

SECTION 052100
STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. Steel joist accessories.
4. Top chord extensions.

1.2 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."

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Welding certificates.
- C. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.5 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."

1.6 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.

1.7 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 on Drawings.
 - 1. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/240 of the span.

2.2 STEEL JOISTS

- A. K-Series Steel Joist: Manufactured 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 and KCS-type K-series steel joists.
 - 2. K-Series 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.
 - 3. Provide holes in chord members for connecting and securing other construction to joists.

4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099000 "Painting" for joists exposed in the finished condition.

2.4 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint.

C. Steel bearing plates with integral anchorages are specified in Section 051200 "Structural Steel."

D. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

E. Welding Electrodes: Comply with AWS standards.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 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.

B. Do not prime paint joists and accessories.

C. Shop priming of joists and joist accessories is specified in

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 High-Strength 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 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

- b. Apply a compatible primer of same type as primer used on adjacent surfaces.
- 2. Cleaning and touchup painting are specified in Section 099123 "Interior Painting."

3.4 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/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 053100
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Noncomposite form deck.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Noncomposite form deck.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - a. Power-actuated mechanical fasteners.
2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store products in accordance with SDI MOC3. 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 in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; 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 listings of another qualified testing agency.

2.2 ROOF DECK

- A. Manufacturers: Steel Deck Institute member.
- B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
 1. Galvanized-Steel Sheet: Minimum yield stress (Fy) = 40 ksi, G60 zinc coating
 2. Deck Profile: As indicated .
 3. Profile Depth: As indicated .
 4. Design Uncoated-Steel Thickness: As indicated .
 5. Span Condition: Triple span .
 6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 NONCOMPOSITE FORM DECK

- A. Manufacturers: Steel Deck Institute members.

- B. Fabrication of Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: Minimum yield stress (F_y) = 40 ksi, G60 zinc coating.
 2. Profile Depth: As indicated. .
 3. Design Uncoated-Steel Thickness: As indicated .
 4. Span Condition: Triple span.
 5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.4 ACCESSORIES

- A. 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 standards 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, 0.0747 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. Galvanizing Repair Paint: ASTM A780/A780M .

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 in accordance with SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

- 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: 5/8 inch, nominal.
 - 2. Weld Spacing: As indicated.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches, or as indicated, 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.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with 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.

3.4 INSTALLATION OF FLOOR DECK

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: As indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, or as indicated, 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 or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with 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 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
 - a. Field welds will be subject to inspection.
 - 2. Steel decking will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 054400
COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cold-formed steel framing in the form of the following:
 - 1. Cold-formed steel trusses for roofs.

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 trusses; 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 trusses.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Mechanical fasteners.
 - 3. Miscellaneous structural clips and accessories.
- D. Field quality-control reports.

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. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

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 trusses.
- B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: As indicated on Drawings:
 - 3. Design trusses to provide for movement of truss 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.
- C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Lateral Design: AISI S213.
 - 3. Roof Trusses: AISI S214.
- 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 or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL TRUSS MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30.

2.3 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard steel sections.

1. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
2. Minimum Base-Metal Thickness: As required by structural performance.
3. Section Properties: As required by structural performance.

2.4 TRUSS ACCESSORIES

- A. Fabricate steel-truss accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.
- B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Power-Actuated Fasteners: 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.
- C. 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.
- D. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.7 FABRICATION

- A. Fabricate cold-formed steel trusses 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 trusses using jigs or templates.
 - 2. Cut truss members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses 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 truss 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 truss to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting trusses and 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. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
 - 1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.

2. Anchor trusses securely at all bearing points.
 3. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."
- B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
 2. Erect trusses without damaging truss members or connections.
 3. Fasten cold-formed steel trusses by welding or mechanical fasteners.
 - a. Comply with AWS D1.3/D1.3M 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.
- C. Install temporary bracing and supports to secure trusses 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 trusses are secured.
- D. Truss Spacing: As indicated on Drawings.
- E. Do not alter, cut, or remove truss members or connections of trusses.

3.3 ERECTION TOLERANCES

- A. Install cold-formed steel trusses 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 trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Cold-Formed Steel Trusses Spanning 60 ft. (18,288 mm) or Longer: Verify temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed according to the approved truss submittal package.

- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A 780/A 780M 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 trusses are 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Steel framing and supports for overhead grilles.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Elevator machine beams, hoist beams.
 5. Steel shapes for supporting elevator door sills.
 6. Shelf angles.
 7. Metal ladders.
 8. Miscellaneous steel trim including loading-dock edge angles.
 9. Metal bollards.
 10. Abrasive metal nosings.
 11. Loose bearing and leveling plates for applications where they are not specified in other Sections.
 12. Metal Grating
- B. Products furnished, but not installed, under this Section:
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.

1.3 PERFORMANCE REQUIREMENTS

- A. 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Metal nosings and treads.
3. Paint products.
4. Grout.

Metal Grating of each type specified and clips and anchorage devices for gratings

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples for Verification: For each type and finish of extruded nosing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 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 and steel weld plates and angles for casting into concrete. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 NONFERROUS METALS

- A. Aluminium Extrusions: ASTM B 221, Alloy 6063-T6.

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 B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A ; with hex nuts, ASTM A 563 ; and, where indicated, flat washers.
- C. 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 E 488, conducted by a qualified independent testing agency.
- D. Post-Installed Anchors: Heavy duty, one piece screw anchor or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, 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 F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work 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.
- 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 will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches , with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 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.
 1. Furnish inserts for units installed after concrete is placed.
- C. Prime miscellaneous framing and supports with zinc-rich primer.
- D. Galvanize miscellaneous framing and supports where indicated.

2.8 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3 unless otherwise indicated.
 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders:
 1. Space siderails 18 inches apart unless otherwise indicated.
 2. Space siderails of elevator pit ladders 12 inches apart.
 3. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
 4. Rungs: 3/4-inch- diameter steel bars.
 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 6. 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.
 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from steel shapes, as indicated.
 - 1. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 - 2. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
- B. Prime bollards with zinc-rich primer.

2.11 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast iron, 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 steps.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply clear lacquer to concealed surfaces of extruded 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. Prime plates with zinc-rich primer.

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 loose steel lintels located in exterior walls.

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 METAL BAR GRATINGS

- A. Welded Steel Grating:
 - 1. Grating Mark W-19-4 (2 x 1/4) STEEL: 2-by-1/4-inch bearing bars at 1-3/16 inches o.c., and crossbars at 4 inches o.c.
 - 2. Grating Mark W-19-4 (3/4 x 1/4) STEEL: 3/4-by-1/4-inch bearing bars at 1-3/16 inches o.c., and crossbars at 4 inches o.c.
 - 3. Traffic Surface: Plain.
 - 4. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.
- B. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- C. Do not notch bearing bars at supports to maintain elevation.

2.16 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 marks and stretch lines, and to blend into surrounding surface.
- D. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

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. 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.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. 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 METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.5 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.7 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preassembled steel stairs with concrete-filled treads.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, 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/240 or 1/4 inch, whichever is less.
- C. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor is 1.5.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preambled Stairs: Commercial class.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. 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."

1.5 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 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 A 36/A 36M.
- B. Wire Rod for Grating Crossbars: ASTM A 510.
- C. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 NONFERROUS METALS

- A. Aluminium Extrusions: ASTM B 221, Alloy 6063-T6.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, 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 A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be shop primed with zinc-rich primer.
- 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 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 E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 "Paints and Coatings".
- C. Concrete Materials and Properties: Comply with requirements in Division 03 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. 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 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 2 welds: completely sanded joint, some undercutting and pinholes okay.
- 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.

2.7 STEEL-FRAMED STAIRS

- 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. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
- B. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements indicated.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board 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.
- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms 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-rolled steel sheet unless otherwise indicated.
 2. Shape metal pans to include nosing integral with riser.

2.8 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. 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.

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 030 "Cast-in-Place Concrete."

3.2 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 09 "Paints and Coatings".

END OF SECTION

SECTION 055210
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. Aluminum pipe railings.
- 2. Steel pipe and tube railings.

1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

- 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- 2. Steel: 72 percent of minimum yield strength.

- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

- 1. Handrails:

- 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. Top Rails of Guards:

- a. Uniform load of 50 lbf/ ft. applied in any direction 50 lbf/ ft. applied horizontally and concurrently with 100 lbf/ ft. applied vertically downward.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

- 3. Infill of Guards:

- a. Concentrated load of 50 lbf 200 lbf applied horizontally on an area of 1 sq. ft.
- b. Uniform load of 25 lbf/sq. ft. applied horizontally.
- c. Infill load and other loads need not be assumed to act concurrently.

- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components,

failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
 2. Grout, anchoring cement, and paint 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 Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting members at intersections.
- E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."

- C. Stairs, guardrails and handrails shall comply with the Virginia Building Code (VBC).
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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 railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. 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.

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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aluminum Pipe and Tube Railings:
 - a. AlumaGuard Corp.
 - b. ATR Technologies, Inc.
 - c. Blum, Julius & Co., Inc.
 - d. Braun, J. G., Company; a division of the Wagner Companies.
 - e. CraneVeyor Corp.
 - f. Hollaender Manufacturing Company.
 - g. Moultrie Manufacturing Company.
 - h. Pisor Industries, Inc.
 - i. Sterling Dula Architectural Products, Inc.
 - j. Superior Aluminum Products, Inc.

- k. Thompson Fabricating, LLC.
- l. Tubular Specialties Manufacturing, Inc.
- m. Tuttle Aluminum & Bronze.
- n. Wagner, R & B, Inc.; a division of the Wagner Companies.

2. Steel Pipe and Tube Railings:

- a. Pisor Industries, Inc.
- b. Sharpe Products.
- c. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 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.

2.3 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 Tubing: ASTM B 221 , Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B 210 , Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209 , Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B 247 , Alloy 6061-T6.
- G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
- H. Woven-Wire Mesh: Intermediate-crimp square pattern, 1-inch woven-wire mesh, made from 0.162-inch nominal diameter wire complying with ASTM B 211 , Alloy 6061-T94.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- B. Pipe: ASTM A 53/A 53M, 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 exterior installations and where indicated.

- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.
- E. Expanded Metal: ASTM F 1267, Type I (expanded), Class 1 (uncoated).

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 304 stainless-steel fasteners.
 - 2. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- 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 otherwise indicated.
- D. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.

- e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
 - E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
 - G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations where indicated 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.

2.7 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. Assemble railings in the shop 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 will be exposed to weather in a manner to exclude 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. Form changes in direction as follows:
1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- J. Form simple and compound curves by bending members in 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.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. 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.
- M. 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 fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. 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.
- O. 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 steel plate forming bottom closure.
- P. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe 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.
1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- 2.8 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.10 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
 - 1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Do not apply primer to galvanized surfaces.
 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 have been 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 have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. 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. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- 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. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to

railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches 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 nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel 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 same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

SECTION 061050
MISCELLANEOUS 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. Framing with dimension lumber.
- 2. Wood blocking and nailers.
- 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. SPIB: The Southern Pine Inspection Bureau.
 - 3. WCLIB: West Coast Lumber Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.
 - 5. NLGA: National Lumber Grades Authority.
 - 6. RIS: Redwood Inspection Service.
 - 7. WCLIB: West Coast Lumber Inspection Bureau.
 - 8. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. 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 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece .
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood equipment support bases.
 - 2. Wood blocking at coping.

2.3 Preservative Treatment by Pressure Process:

- 1. Lumber: AWPAC2 except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX). Kiln dry after treatment to a maximum moisture content of 19 percent.
- 2. Plywood: AWPAC9. Kiln dry after treatment to a maximum moisture content of 18 percent.
- 3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- 4. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- 5. Do not use material that is warped or does not comply with requirements for untreated material.
- 6. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- 7. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
 - 3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece .
- C. Application: Treat all miscellaneous carpentry, including the following, unless otherwise indicated:
 - 1. Concealed blocking.
 - 2. Roof construction.
 - 3. Plywood backing panels.

2.5 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent.
- B. Other Framing: No. 2 grade and any of the following species:
 - 1. Southern pine; SPIB.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Spruce-pine-fir (south); NeLMA, 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.

2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M .
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. 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.

2.9 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cleveland Steel Specialty Co.
 - 2. Harlen Metal Products, Inc.
 - 3. KC Metals Products, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. Southeastern Metals Manufacturing Co., Inc.
 - 6. USP Structural Connectors.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations where stainless steel is not indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. 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.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- G. 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.
- H. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.

- I. Securely attach 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.
- J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label

END OF SECTION

SECTION 061600
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes: Wall sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

- A. Glass-mat gypsum wall sheathing.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.3 MANUFACTURERS

- A. Provide products by one of the following manufacturers:
 - 1. Certain Teed Corporation; GlasRoc
 - 2. G-P Gypsum Corporation; Dens-Glas Gold
 - 3. United States Gypsum Company; Securock
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION

SECTION 064100
INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim.
 - 2. Wood cabinetry (not of stock design).
 - 3. Custom wood trim not specified in other Sections.
 - 4. Shop finishing of woodwork.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

1.3 REFERENCES

- A. Architectural Woodwork quality Standards, Architectural Woodwork Institute (AWI)

1.4 SUBMITTALS

- A. Comply with the requirements of Div 1 Section 01340 Submittal Procedures.
- B. For Approval:
 - 1. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
 - 2. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - a) Show details full size.
 - b) Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
 - c) Show locations and sizes of cutouts and holes for items installed in architectural woodwork.
 - d) Show veneer leaves with dimensions, grain direction, exposed face, and an identification number indicated for each leaf. Identification number shall indicate the flitch and the sequence within the flitch for each leaf.
- C. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes.
 2. Plastic laminates.
 3. Solid surfacing material.
- D. Samples for verification of the following:
1. Lumber with or for stained and transparent finish, 50 sq. in., for each species and cut, finished on one side and one edge.
 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 3. Wood-veneer-faced panel products, with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish one-half of face as specified.
 4. Step finish materials on sample to show and clearly define each coat.
 5. Provide separate samples of unfaced panel product used for core.
 6. Laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 7. Solid surfacing material 6" x 6"
 8. Exposed hardware, one unit for each type and finish.
- E. Product Data: For solid-surfacing material fire-retardant-treated materials.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- F. For Information:
1. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.
 2. Qualification data for firms and persons specified in the *Quality Assurance* Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.
- C. Single-Source Responsibility: Arrange for production of interior architectural woodwork with sequence-matched wood veneers by a single firm.
1. Include the veneering of wood doors in the single-firm production where veneer matching extends across wood doors.

- D. Single-Source Responsibility for Fabrication and Installation: Engage a qualified woodworking firm to assume undivided responsibility for fabricating, finishing, and installing woodwork specified in this Section.
- E. Quality Standard: Except as otherwise indicated, comply with the following standard:
 - 1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - a) Custom Grade

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in the *Project Conditions* Article of this Section.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Obtain and comply with woodwork fabricator's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:
 - 1. Medium-Density Fiberboard: ANSI A208.2.
 - 2. Hardwood Plywood and Face Veneers: HPVA HP-1.
- B. Fiberboard: Medium-density fiberboard made without formaldehyde and complying with ANSI A208.2. Color to be selected from manufacturer's full range including charcoal gray.
 - 1. Product: Provide MDF equal Medite II by Medite Corp.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a) Design Standard: Formica Corporation.
 - b) Laminart.
 - c) Wilsonart
 - d) Nevamar
- D. Adhesive for Bonding Plastic Laminate: As recommended by laminate manufacturer for the intended use of the laminate assembly.
- F. Wood materials:
 - 1. Exposed face and veneer lumber:
 - a) Graded in accordance with AWI for grade of work specified.
 - b) Maple or White Birch.
 - c) Plain Sawn
 - d) Of quality suitable for transparent finish in compliance with Custom Grade standards.
 - e) Book matched unless otherwise noted.
 - 2. Plywood:
 - a) Veneer core all hardwood.
 - b) Graded in accordance with AWI for grade of work specified.
- G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 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) ABA Industries.
 - b) Avonite, Inc.
 - c) E. I. du Pont de Nemours and Company.

- d) Formica Corporation.
 - e) LG Chemical, Ltd.
 - f) Meganite Inc.; a division of the Pyrochem Group.
 - g) Samsung; Cheil Industries Inc.
 - h) Swan Corporation (The).
 - i) Transolid, Inc.
 - j) Wilsonart International; Div. of Premark International, Inc.
2. Colors and Patterns: As selected by Architect from manufacturer's FULL range.

2.2 HARDWARE AND ACCESSORY MATERIALS

- A. Hardware Schedule: Refer to schedule at end of this Section for cabinet hardware required for architectural cabinets.
- B. For concealed hardware, where finish is not indicated, provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.
- C. Exposed Hardware finish: unless otherwise noted, hardware finish shall be brushed stainless or brushed chrome.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content, fire retardant treated as required by Code.
- B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.
 - 1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- C. Nails: Select material, type, size, and finish required for each use.
- D. 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 bolt devices for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
 - 1. Grade: Custom.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch thick or less: 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.
- D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at the 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 approved shop drawings before disassembling for shipment.
- E. Shop-cut openings, to maximum extent possible, to receive hardware, fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.
- F. Core Material:
 - 1. Horizontal surfaces: All hardwood veneer core plywood
 - 2. Vertical Surfaces: All hardwood veneer core plywood for MDF 40 at Contractor's option.
 - 3. Doors: Provide solid bearing for hinges.

2.5 FINISH

- A. Finish work in the factory in accordance with AWI Quality Standards - Section 1500 Systems.
 - 1. Quality Standard: Custom Grade.
- B. Stain and transparent finish to match color and sheen selected and approved for wood doors.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.
 - 1. Grade: Custom.
- B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- D. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.
- E. Wood Species: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.
 - 1. Provide split species on trim that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

2.7 COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for countertops.
 - 1. Grade: Custom.
 - 2. High Pressure Decorative Laminate, "Premium" grade. Provide edge profile indicated.
 - 3. Board Material:
 - a) Sinks: Provide Type II veneer core hardwood plywood or phenolic resin 45 psf density particle-board with 3/4" thickness built up to 1-1/4" with backer ply for "non-drip" edge profile.
 - b) W/O Sinks: Provide 1-3/16" solid particleboard, 45 psf density (industrial grade).
- B. Laminate Cladding for Horizontal Surface: High pressure decorative laminate complying with NEMA LD 3 and as follows:
 - 1. Colors, Patterns, and Finishes: As indicated or, if not otherwise indicated, as selected from laminate manufacturer's standard products in full range of solid & matrix colors, matte finish.
 - 2. Grade: PF-42 (0.042" nominal thickness, roll-form material) at sink counters. GP-50 (0.050" nominal thickness) at counters without sinks.
 - 3. Edge Treatment: Same as laminate cladding on horizontal surface unless noted otherwise.

2.8 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 900.
 - 1. Grade: Custom.

- B. Wood Species: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

2.9 SHOP FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
 - 1. Grade: Provide finishes of same grades as items to be finished.
- B. General: The entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation.
 - 1. Shop Finishing: To the greatest extent possible, finish architectural woodwork at the fabrication shop. Defer only final touch up, cleaning, and polishing until after installation.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork, including backs of trim, cabinets, paneling, and ornamental work and the underside of countertops. Apply 2 coats to back of paneling. Concealed surfaces of plastic laminate-clad woodwork do not require backpriming when surfaced with plastic laminate or thermoset decorative overlay.
- D. Washcoat for Stained Finish: Apply a vinyl washcoat to woodwork made from closed-grain wood before staining and finishing.
- E. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- F. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - 1. Apply vinyl washcoat sealer after staining and before filling.
- G. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
 - 1. Grade: Custom.
 - 2. AWI Finish System TR-2: Catalyzed lacquer or TR-4 Conversion Varnish as used on interior doors. Refer to Division 8 Section *Flush Wood Doors*.
 - 3. Staining: Match approved door finish
 - 4. Sheen: Match approved door finish

PART 3 EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches for plumb and level (including tops).
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches long, except where necessary. Stagger joints in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
 - 1. Install standing and running trim with no more than 1/8 inch in 96-inch variation from a straight line.
- G. Cabinets: Install without distortion so that 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 the installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.

- H. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
- I. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.
 - 1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
- J. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

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 semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

- A. Grommets for cable passage: HAFELE Catalog #429.93.322
- B. Grommets – round trash ring: HAFELE Catalog #631.24.093
- C. Metal Handles: Stanley, Ives. Satin anodized aluminum; 5/16Ø, “U” pull 1-5/16" proj. x 3-1/2" centers.
- D. Knuckle Hinges for flush overlay: Stanley 1592
- E. Magnetic Catches: HAFELE Catalog # 246.26/246.29, finish selected by Architect.
- F. Shelf Supports:
 - 1. Cabinet Shelves: HAFELE Catalog # 283.07.011
 - 2. Wall Mounted Shelves:

- a) 16 gauge steel, with electroplated finish statuary bronze.
 - (1) Product number 80 by Knape & Vogt
 - (2) Product number 180 by Knape & Vogt
- G. Locks:
 - 1. Lever Type Cam Lock: Similar to HAFELE Catalog #235.04, operating in the G and H directions, suitable for a 1-3/8 inch door.
 - a) Flush screw mounted striking plate suitable to receive strike of cam lock.

END OF SECTION

SECTION 071113
BITUMINOUS DAMPPROOFING

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. Cold-applied, emulsified-asphalt dampproofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ChemMasters Corp.
2. Degussa Building Systems; Sonneborn Brand Products.
3. Gardner Gibson, Inc.
4. Henry Company.
5. Karnak Corporation.
6. Koppers Inc.
7. Malarkey Roofing Products.
8. Meadows, W. R., Inc.
9. Tamms Industries, Inc.

B. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

C. VOC Content: 0.25 lb/gal. or less.

2.2 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
 - 3. Allow 24 hours drying time prior to backfilling.
- B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior.
 - 1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 - 2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.
 - 1. Lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 2. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe, and lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.
- D. Apply dampproofing to provide continuous plane of protection on interior face of above-grade, exterior concrete and masonry walls unless walls are indicated to receive direct application of paint.
 - 1. Continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by delaying construction of intersecting walls until dampproofing is applied.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. On Concrete Foundations: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft. , or 1 trowel coat at not less than 4 gal./100 sq. ft.
- B. On Unparged Masonry Foundation Walls: Apply primer and 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, primer

and 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft. , or primer and 1 trowel coat at not less than 5 gal./100 sq. ft.

- C. On Unexposed Face of Concrete Retaining Walls: Apply 1 brush or spray coat at not less than 1.25 gal./100 sq. ft.
- D. On Unexposed Face of Masonry Retaining Walls: Apply primer and 1 brush or spray coat at not less than 1.25 gal./100 sq. ft.
- E. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and 1 brush or spray coat at not less than 1 gal./100 sq. ft.
- F. On Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply 1 brush or spray coat at not less than 1 gal./100 sq. ft.

3.5 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 071353
ELASTOMERIC SHEET WATERPROOFING

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. EPDM rubber sheet waterproofing.
 - 2. Molded-sheet drainage panels.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing.
 - 2. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of units required for this Project.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Installer's Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 SHEET WATERPROOFING

- A. EPDM Rubber Sheet: ASTM D 6134, Type I, 60-mil- thick flexible sheet, unreinforced, formed from EPDM.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing Inc.; Sure-Seal EPDM.

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing or 60-mil- thick, uncured EPDM as required by manufacturer.
- C. Bonding Adhesives: Adhesive for bonding polymeric sheets and sheet flashings to substrates and projections.
- D. Splicing Cement and Cleaner: Single-component butyl splicing cement and solvent-based splice cleaner.
- E. Lap Sealant: Single-component sealant.
- F. In-Seam Sealant: Single-component sealant.
- G. Waterproofing and Sheet Flashing Accessories: Provide sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.
- H. Protection Course: Faced, fan folded, with a core of extruded-polystyrene board insulation sandwiched between 2 sheets of plastic film, nominal thickness 1/4 inch , with compressive strength of not less than 8 psi per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.

2.3 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Do not proceed with installation until after the minimum concrete curing period recommended by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Notify Architect in writing of anticipated problems using waterproofing over substrate.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 FULLY ADHERED SHEET INSTALLATION

- A. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D 5843.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply bonding adhesive to substrates at required rate and allow to partially dry.
- D. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.

- E. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

3.4 SEAM INSTALLATION

- A. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to produce a splice not less than 6 inches wide and to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.

3.5 SHEET FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.

3.6 PROTECTION COURSE INSTALLATION

- A. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.

3.7 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install protection course before installing drainage panels.

3.8 PROTECTION AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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. Cavity-wall insulation.
 - 2. Concealed building insulation.
 - 3. Vapor retarders.
 - 4. Sound attenuation insulation.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosum on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Manufacturers subject to compliance with specifications:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
 - e. Johns Manville AP Foil-Faced Foam Sheathing.
 2. Type VI, 1.80 lb/cu. ft..
 3. Locations:
 - a. 2" board: Exterior perimeter of new concrete slabs.
- B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2 , with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches .
1. Manufacturers:
 - a. Atlas Roofing Corporation.
 - b. Dow Chemical Company.
 - c. Rmax, Inc.

2.3 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84. Exterior wall assemblies are to comply with VCC 2603.5 and NFPA 285 (typical). Coordinate and indicate that wall assembly compliance requirement is being met in shop drawing submittals for various components of interior and exterior walls (typical)
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. BaySystems NorthAmerica, LLC.
 - c. Dow Chemical Company (The).
 - d. ERSystems, Inc.
 - e. Gaco Western Inc.
 - f. Henry Company.
 - g. NCFI; Division of Barnhardt Mfg. Co.
 - h. SWD Urethane Company.
 - i. Volatile Free, Inc.
 - j. Johns Manville JMCorbond IV closed-cell spray polyurethane foam.
 2. Minimum density of 1.5 lb/cu. ft. thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 3. Henry Company (Permax 2.0X and Perma 2.0X fast closed cell spray-applied polyurethane foam insulation) is the basis of design per ICC-ES evaluation Report # ESR-3647.

B. Plastic Insulation Characteristics

1. Plastic insulation in exterior walls shall comply with requirements of VCC 2603.5 Exterior walls of buildings of any height. Exterior wall assemblies shall comply with and be tested to the criteria of NFPA 285. Provide test documentation for all wall assemblies.
2. Provide thermal barrier at all exterior walls to separate the plastic insulation from the interior. Refer to VCC 2603.5.2 Thermal barrier.
3. The plastic insulation in exterior walls shall have a maximum flame spread rating of 25 and a maximum smoke-developed index of 450 when tested per ASTM 84 or UL 263. Refer to VCC 2603.5.4.
4. The potential heat from the plastic insulation in exterior walls shall not exceed the heat developed in Btu/s per square foot as allowed by the test assembly according to NFPA 259. Refer to VCC 2603.5.3 Potential heat.

2.4 GLASS-FIBER BLANKET INSULATION

A. Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-5/8 inches thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F .
2. 5-1/2 inches thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F .

2.5 Sound Attenuation Batts

A. Type: Unfaced glass fiber acoustical insulation complying with

B. ASTM C 665, Type I.

C. Surface Burning Characteristics:

1. Maximum flame spread: 10
2. Maximum smoke developed: 10

When tested in accordance with ASTM E 84.

- D. Combustion Characteristics:
 - 1. Passes ASTM E 136.
- E. Fire Resistance Ratings:
 - 1. Passes ASTM E 119 as part of a complete fire tested wall assembly.

2.6 VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. , with maximum permeance rating of 0.1317 perm and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
 - 1. Products:
 - a. Raven Industries Inc.; DURA-SKRIM 2FR.
 - b. Reef Industries, Inc.; Griffolyn T-55 FR.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

2.7 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.8 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Products:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Products:
 - a. Gemco; 90-Degree Insulation Hangers.
 2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Products:
 - a. AGM Industries, Inc.; RC150.
 - b. AGM Industries, Inc.; SC150.
 - c. Gemco; Dome-Cap.
 - d. Gemco; R-150.
 - e. Gemco; S-150.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
 - b. Attic spaces.
 - c. Where indicated.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.
1. Products:
 - a. Gemco; Clutch Clip.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Products:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.

- c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, 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.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation 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. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. 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.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
 - 6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- E. 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.

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install 3-inch- thick, unfaced glass-fiber blanket insulation over suspended ceilings so that insulation extends over entire ceiling.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.7 PROTECTION

- A. Protect installed insulation and vapor retarders 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

SECTION 072500
WEATHER BARRIERS

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. Water And Vapor Resistive Barrier
 2. Building Wrap (vapor retarder).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 - PRODUCTS

2.1 WATER AND VAPOR RESISTIVE BARRIER

- A. Water and Vapor Membrane.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Henry Company (The); "Blueskin SA".
- B. Properties.
1. 1.5mm (60 mils) SBS modified bitumen, self-adhering sheet membrane with a cross-laminated polyethylene film, and having the following physical properties:
 2. Thickness: 1.5 mm (60 mils) min.,
 3. Flexibility: Pass @ -40 degrees C to ASTM D1970, 3. Vapour permeance: 2.8 ng/Pa.s.m² (0.05 perms) to ASTM E96,
 4. Tensile strength (membrane): 2.24 MPa to ASTM D412,
 5. Tensile strength (film): 34.5 MPa to ASTM D882,
 6. Elongation: 300% to ASTM D412,
 7. Puncture resistance: 222 N min. to ASTM E154.

2.2 BUILDING WRAP

A. Building Wrap.

1. Products: Subject to compliance with requirements, provide the following:

- a. VaproShield LLC; "WrapShield SA".

B. Properties.

1. Nominal Thickness: 26 mils (0.65mm).
2. Application Temperature: Air & surface minimum + 20°F.
3. Service Temperature, - 40°F to 180°F (- 40°C to + 82.2°C).
4. Water Resistance: AATCC – 127, PASS (22 in. head of water – 5 hrs).
5. Air Permeance: ASTM 2178, 0.0000263 cfm/ft² @ 75 Pa, 0.000134 L/s/m² @ 75 Pa.
6. Air Barrier: ASTM E 2357.05*, PASS <0.01 cfm/ft².
7. Water Vapor Transmission: ASTM E96 – Method B, 50 Perms.
8. Peel Adhesion: ASTM D3330, 37.6 oz/in.
9. Tensile Strength: ASTM D882, MD 44.8 lbf/in CD 25.1 lbf/in.
10. Flame Spread: ASTM E-84, 10 - Class A.
11. Smoke Development Index: ASTM E-84, 15 - Class A.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 1. Seal seams, edges, fasteners, and penetrations with tape.
 2. Extend into jambs of openings and seal corners with tape.

END OF SECTION

SECTION 074110
METAL ROOF 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. Factory-formed and field-assembled, standing-seam metal roof panels. (prefinished steel sheet)
 - 2. Gutters and downspouts (prefinished aluminum sheet – steel sheet fabrications not acceptable)
 - 3. Soffit Panels.
 - 4. Snow Rails.

1.3 DEFINITIONS

- A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.
- B. Solar Flux: Direct and diffuse radiation from the sun received at ground level over the solar spectrum, expressed in watts per square meter.
- C. Solar Reflectance: Fraction of solar flux reflected by a surface, expressed as a decimal fraction within the range of 0.00 and 1.00.
- D. Emissivity: Fraction of solar flux in the infrared spectrum range reflected by a surface. Expressed as a decimal fraction within the range of 0.00 and 1.00.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Water Penetration: None when tested per ASTM E 1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft..
 - 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - 3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

- D. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail Resistance: MH.
- E. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - 1. Design Loads: As indicated, in accordance with the VUBC, 2021 Edition.
- F. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- G. Solar Reflectance for Roofs with Slopes Steeper Than 2:12: Initial solar reflectance of not less than 0.25 when tested according to ASTM E 903, and maintained, under normal conditions, solar reflectance not less than 0.15 for 3 years after installation.
- H. Emissivity: Provide minimum emissivity or .9 when tested according to ASTM E 408.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
 - 1. Accessories: Include details of the following items, at 1-1/2 inches per 12 inches scale minimum:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - d. Snow guards.
 - 2. 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. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Roof panels and attachments.
 - 2. Louvers at roof dormers.
 - 3. Trim and closure details at aluminum storefront at metal roof areas indicated.

4. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, etc.
- D. Samples for Initial Selection: For metal roof panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For exposed finish required, prepared on Samples of size indicated below.
 1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 3. Accessories: 12-inch- long Samples for each type of accessory.
- F. Qualification Data: For Installer and professional engineer.
- G. Material Certificates: For thermal insulation and vapor retarders, signed by manufacturers.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 1. Metal Roof Panels: Include reports for water penetration, solar reflectance, emissivity, and structural performance.
 2. Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- I. Maintenance Data: For metal roof panels to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.
- K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation. Also submit copies of field inspection reports for startup and in-progress inspections.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 1. Installer's responsibilities include fabricating and installing metal roof panel assemblies and providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of data for metal roof panels, 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 metal roof panels and accessories through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site of the Contractor, roofing installer, representative of roofing system manufacturer, and representatives of trades involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Advise Architect and Owner of scheduled meeting date. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
 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 methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
 4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 5. Review structural loading limitations of deck during and after roofing.
 6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 8. Review temporary protection requirements for metal roofing during and after installation.
 9. Review roof observation and repair procedures after metal roof panel installation.
 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
- D. Inspection Reports of Roofing Manufacturer's Representative: Roofing manufacturer's representative shall inspect the work and provide copies of his inspection reports to the Architect and the Owner. The Installer shall notify manufacturer's representative of intended start date & schedule of roofing work.
1. The Installer and Roofing manufacturer's representative shall inspect the substrate surfaces (deck) to receive roofing system prior to beginning installation.
 2. The roofing manufacturer's representative shall inspect the work no less than three times (startup, in-progress, and end-of-installation warranty inspection) during the application of the system & submit copies of inspection reports to the Architect & Owner within 7 days of the inspection.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
 - B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.
- E. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Flashing, Sheet Metal Flashing and Roofing Accessories."
- B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and non-corrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply 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. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
 4. Basis-of-Design Product: The design for each metal roof panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
 3. Surface: Smooth, flat finish.
 4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
 - a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive

primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

- a) Humidity Resistance: 2000 hours.
- b) Water Resistance: 2000 hours.

2) Provide minimum solar reflectance value and emissivity specified.

- 5. Concealed Finish: Apply pretreatment and 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.

B. Panel Sealants:

- 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
- 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL ROOF PANELS

- A. Refer to Division 7 Section "Building Insulation."

2.4 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397. (Provide below insulation at acoustical metal deck areas only.)
- B. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 - 2. Low Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 - 3. Available Products:
 - a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "HR."
 - b. Grace, W. R. & Co.; Vycor Ultra.
 - c. Henry Company; Perma-Seal PE.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. TC MiraDRI; WIP 300HT.

2.5 MISCELLANEOUS METAL FRAMING

- A. General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.

- B. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0179 inch
 - 2. Depth: 7/8 inch.
- C. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Comply with ASTM E 1514.
 - 2. Basis-of-Design Products:
 - Roof Assembly (RA-2): McElroy Metal "Medallion Lok" concealed fastener standing seam snap lock panels
 - Roof Assembly (RA-2): McElroy Metal "Maxima" concealed fastener standing seam mechanically seamed panels suitable for low slope applications (1/2:12)

Or a comparable products from one of the following manufacturers:

- a. AEP-Span.
- b. Architectural Metal Systems
- c. ATAS International, Inc.
- d. Berridge Manufacturing Company.
- e. CENTRIA Architectural Systems.
- f. Imetco
- g. MBCI; Div. of NCI Building Systems.
- h. Merchant & Evans, Inc.
- i. Steelox Systems Inc.

3. Material: Zinc-coated (galvanized) steel sheet, or Aluminum-zinc alloy-coated steel sheet, minimum 0.0239 inch (24 gage) thick or as required to comply with wind loading.
 - a. Exterior Finish: Fluoropolymer
 - b. Color: Selected from full range of manufacturer's standard colors
4. Clips: Fixed and Floating type to accommodate thermal movement. Pin at ridge and accommodate expansion at eave unless approved otherwise.
 - a. Material: thickness (gage) required for loading, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
5. Profile: Vertical leg standing seam panel with male/female seams that are interlocked via snapping during installation Panel Coverage: 16 inches.
6. Size: minimum 1.75" high seam by 16" width.
7. Uplift Rating: UL 90.

2.8 ACCESSORIES

- A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
 2. Clips: Minimum 0.0625-inch- thick, stainless-steel panel clips designed to withstand negative-load requirements.
 3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- thick, stainless-steel or nylon-coated aluminum sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. 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. Finish flashing and trim with same finish system as adjacent metal roof panels.
- C. Surface-Mount Gutter and Down Conductors: Provide .040" aluminum gutter fabrication per SMACNA standards (5th edition -1993), Figures noted, with bottom-outlet drain. Provide butt type gutter expansion joint with loose lock expansion joint cover cap detail between gutter sections, and formed cover plate per Figure 1-7. Provide continuous support cleat and gutter hangers per Figure 1-17. Provide aluminum or stainless steel wire ball strainers at outlets. Provide all details, accessories, trim and fasteners to incorporate gutter fabrication into the roofing eave detail for leak-free installation.

1. Provide matching with AAMA 2605 (formerly 605.2) fluoropolymer high performance finish for entire gutter and downspout assembly. Provide 2-coat, non-metallic colors of PPG "Duramar" or Valspar "Fluoropon." Color required for project:
 - a. Gutter Color: As selected by Architect from manufacturer's full range .
 - b. Downspout Color: As selected by Architect from manufacturer's full range .
 2. Provide .030" aluminum 4-inch square down spouts of height required, complete with elbows and offsets. Provide wall brackets at 8'-0" spacing maximum, minimum of one at top and bottom. Provide down spout outlet into cast iron boots. Downspouts fabricated from steel are not acceptable.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Architectural Products Co.
 - b. Metal Era Corporation
 - c. MM Systems Corporation
 - d. Perimeter Systems (Div. Southern Aluminum Finishing Co.)
- D. Snow Rails: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.
1. Seam-Mounted, Rail type Snow Guards: Cast-aluminum stops designed for attachment to vertical ribs of standing-seam metal roof panels with stainless-steel set screws.
 - a. Available Products:
 - 1) Alpine Snow Guards - ASG4025-Mini
 - 2) S-5! - DualGard
 - 3) Berger Bros. Co. - F-Rail system
 - b. Design Requirements:
 - 1) Spacing to be recommended by manufacturer
 - 2) Install a minimum of (2) set screw per snow guard
 - 3) Rod-style snow guards must have a break in the assembly every 48-foot eave length to allow for thermal expansion
 - 4) Installed rods should not overhang the end brackets by more than 6"
 - c. Submittal: Submit manufacturer's specifications, standard detail drawings, installation instructions, and recommended layout
 - d. Delivery / Storage . Handling: Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed
- E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.9 FABRICATION

- A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as

necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 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.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES, GENERAL

- 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: 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Provide vapor barrier of 6-mil polyethylene or alternate approved material over perforated acoustical metal deck prior to installing insulation. (This protects acoustical deck from roofing system adhesives and contaminants.)
- C. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Flashing, Sheet Metal Flashing and Roofing Accessories."
 - 1. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet Underlayment: Install polyethylene sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for anchorage to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under metal roof panels. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
 - 2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
 - 3. Rake edges for a distance of 18 inches.
 - 4. Hips and ridges for a distance on each side of 12 inches.
 - 5. Roof to wall intersections for a distance from wall of 18 inches.
 - 6. Around dormers, cupola, and other penetrating elements for a distance from element of 18 inches.
- C. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Flashing, Sheet Metal and Roofing Accessories."

3.4 METAL ROOF PANEL INSTALLATION, GENERAL

- A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Fasteners used to secure "clips" (roof fastener system) to deck shall be of sufficient length and strength to pass through insulated nail base system and 1" into structural metal decking below.
 - 2. Field cutting of metal roof panels by torch is not permitted.
 - 3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
 - 4. Provide metal closures at peaks, rake edges, rake walls and each side of ridge caps.
 - 5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 6. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 7. Install ridge caps as metal roof panel work proceeds.
 - 8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.
- B. Fasteners:
 - 1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
 - 2. Fasteners installed in Acoustic Deck exposed view from interior spaces: Use fasteners that do not extend through the bottom panel of acoustic deck.
 - 3. Fasteners used to secure "clips" (roof fastener system) to deck shall be of sufficient length and strength to pass through insulated nail base system and 1" into structural metal decking below.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
 - 1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.5 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL ROOF PANELS

- A. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 7 Section "Building Insulation."
 - 1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches o.c.

3.6 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

- A. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 5. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
 - 7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners. Fasteners used to secure "clips" (roof fastener system) to deck shall be of sufficient length and strength to pass through insulated nail base system and 1" into structural metal decking below.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.7 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.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 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 with no joints allowed within 24 inches 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 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 not more than 4 feet 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 telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches 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.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- F. Stop-Type Snow Guards: Attach snow guards to metal roof panel standing seams, as recommended by manufacturer. Do not use fasteners that will penetrate metal roof panels.
 - 1. Provide two rows of snow guards, at roof eaves, spaced at each standing seam, beginning 24-inches up from gutter.
- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.8 SOFFIT PANEL INSTALLATION

- A. Concealed-Fastener Formed Metal Soffit Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project

drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

- B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading panel flange. Fit back flange of subsequent panel into secured flange of previous panel. Where indicated, fasten panels together through flush-fitted panel sides.
 - 1. Cut panels in field where required using manufacturer's recommended methods.
 - 2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074310
COMPOSITE PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-faced metal composite material (MCM) panels, attachments and sealants.

1.2 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:
 - 1. Submit test data witnessed by an independent testing agency for the following requirements:
 - a. Structural tests for wind loads by "Chamber Method" in compliance with ASTM E72.
 - 1) Standard test design loading: 20 psf (960 Pa) positive and negative wind load.
 - 2) Design panel system to withstand code imposed design loads and a deflection limit of L/180 shall apply to positive load pressures only.
 - 3) Design panel system to withstand code imposed design loads and a deflection limit of L/175 shall apply to positive load pressures only.
 - b. 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/sq m) when tested in accordance with ASTM E283.
 - c. 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/sq m) when tested in accordance with ASTM E331.

1.3 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. 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. Selection 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 (76 mm) by 5 inches (128 mm) 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.

1.4 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 this 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.

1.5 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 insure 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 degrees F (49 degrees C).
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 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.

1.7 WARRANTY

- A. Finish Warranty: Commencing on Date of Substantial Completion.
 - 1. Provide 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: Commencing on Date of Substantial Completion.
 - 1. Panels covered by this warranty are warranted not to delaminate (separate) for a period of five years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers shall include, but are not limited to:
 - 1. Alucobond.
 - 2. Reynoldbond.
 - 3. SAF.
 - 4. Alfex FR
- B. Requests for substitutions will be considered in accordance with provisions of Division 1.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Panel Deflection Limit: For wind loads, no greater than 1/60 of the span.
 - 3. Framing Member Deflection Limits: For wind loads, no greater than 1/175 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested in accordance with ASTM E283 at a test-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 a test-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Locate expansion and contraction points to allow for free and noiseless thermal movements from surface temperature changes at a range of 20 deg F to 180 deg F (minus 29 to 82.2 deg C), material surfaces.

- E. Fire Propagation Characteristics: MCM wall assembly passes NFPA 285 testing.
- F. Rainscreen Cladding Performance:
 - 1. AAMA 508: Water mist or water droplets appearing in less than 5% of the air/water barrier surface, and no continuous streaming at any location on the air/water barrier. Pressure equalization lag time between the cavity and cyclic wind pressure shall not exceed 0.08 sec². The maximum differential between the cavity and the cyclic wind pressure shall not exceed 50% of the maximum test pressure.
 - 2. AAMA 509: Dynamic water penetration classification no greater than W1 or 1.0oz/ft² and air flow ventilation classification no less than V4 or 6.0 cfm/ft².

2.3 MCM WALL PANELS

- A. MCM Wall Panel Systems: Provide -shop formed and assembled MCM panels formed into profiles for the installation method indicated and per the construction drawings. Include attachment assembly components, panel stiffeners, and accessories required.
 - 1. Alucobond Plus. (Basis of Design)
 - 2. Alpolic.
 - 3. Arconic Architectural Products.
 - 4. Mitsubishi Chemical America.
 - 5. Reynoldbond.
 - 6. SAF.
 - 7. Alfrex FR
- B. Aluminum-Faced Metal Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick aluminum sheet facings.
 - 1. Panel Thickness: 4mm (0.157")
 - 2. Core: Fire retardant.
 - 3. Exterior Finish: Polyvinylidene difluoride (PVDF). The number of coats and film thicknesses shall comply with the specified warranty period and specified basis-of-design finish(es):
 - 4. Peel Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
 - 5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.
- C. Attachment Assembly Components: Formed from extruded aluminum or other compatible material per the construction drawings and in compliance with all required performance testing.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Sub-framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating

designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.

- B. Panel Accessories: Provide components required for a rainscreen panel system including trim and flashing as indicated on the constructions drawings. Match material and finish of MCM panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, and parapet caps.
 - 1. Aluminum Trim: Formed with minimum 0.040-inch (1.00-mm-) thick, coil-coated aluminum sheet unless otherwise indicated on the construction drawings.
 - 2. Basis-of-design Finish: To match MCM wall panel system unless otherwise indicated in the construction drawings.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.5 FABRICATION

- A. General: Fabricate and finish MCM panels and accessories to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensions as indicated on the construction drawings.
- B. Fabricate MCM panel joints to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensions as indicated on the construction drawings.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 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.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces provided by others is acceptable. Variation in appearance from different production batches of finish effects including but not limited to anodized, brushed coil, mica flake, metallic flake, and texture is expected.
- C. Allowable finishes for MCM Panels and Accessories: See basis-of-design finish selection and warranty requirements. Prepare, pretreat, and apply coatings to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Coil Coated Finishes:
 - a. PVDF Fluoropolymer: AAMA 2605. Containing not less than 70 percent PVDF resin by weight in color coat.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. 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 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 (6 mm) in any 20 feet (6 m) length vertically or horizontally.
 - b. 1/2 inch (12 mm) 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. For the record, prepare written report, endorsed by panel installer and substrate installer, listing remedy for conditions detrimental to performance of work.

- C. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.
- D. Proceed with installation only after all unsatisfactory conditions have been corrected.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Comply with manufacturer's installation guides and Product Data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation type selected.
- B. Work shall be done and completed in a thorough and workmanlike manner by mechanics skilled in their various trades.

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 of debris.
- C. Protect installed products until completion of project.
- D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 075420
THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE 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 new fully-adhered membrane roofing system at building additions and patching of existing membrane roofing, roof insulation, and flashings. The Contractor shall maintain existing roofing warranties. Existing roof warranty is attached to this section.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail Resistance: MH.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Energy Star Roofing compliance – Cut sheets or letter from manufacturer stating compliance with the Energy Star Roofs program for flat roof (initial solar reflectance of .65, 3 year aged reflectance of .50). Include statement that roof color emissivity is at least .9.
 - 2. Statement from sheet membrane manufacturer that fire-retardant treatment is a non-bromine, non-halogenated product.
 - 3. Material Safety Data Sheets for adhesives and primers.
- B. Shop Drawings: For roofing system. Include plans, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.

2. Tapered insulation, including slopes.
 3. Insulation fastening patterns.
- C. Samples for Verification: For the following products:
1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
 2. 12-by-12-inch square of roof insulation.
 3. 12-inch length of metal termination bars.
 4. Six insulation fasteners of each type, length, and finish.
 5. Six roof cover fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- H. Research/Evaluation Reports: For components of membrane roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: Special warranties specified in this Section.
- K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation. Also submit copies of field inspection reports for startup and in-progress inspections.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
1. Contractor to be designated as an "Approved Contractor/Installer" by the Manufacturer.
- B. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.
- C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
- D. Preinstallation Conference: Conduct conference at Project site of the Contractor, roofing installer, representative of roofing system manufacturer, and representatives of trades involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Advise Architect and

Owner of scheduled meeting date. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.
- E. Inspection Reports of Roofing Manufacturer's Representative: Roofing manufacturer's representative shall inspect the work and provide copies of his inspection reports to the Architect and the Owner. The Installer shall notify manufacturer's representative of intended start date & schedule of roofing work.
1. The Installer and Roofing manufacturer's representative shall inspect the substrate surfaces (deck) to receive roofing system prior to beginning installation.
 2. The roofing manufacturer's representative shall inspect the work no less than three times (startup, in-progress, and end-of-installation warranty inspection) during the application of the system & submit copies of inspection reports to the Architect & Owner within 7 days of the inspection.
- F. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty ("Total System Warranty"): Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 - 1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, walkway products and other components of membrane roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
 - 1. Manufacturers:
 - a. GAF (existing).
 - b. Carlisle.
 - c. Firestone.
 - d. Johns Mansville
 - 2. Thickness: 60 mils, nominal. Provide 15 mils minimum polyolefin thickness above reinforcing.
 - 3. Exposed Face Color: White.
 - 4. Fire Retardant Treatment: Non-halogenated, non-bromine.
 - 5. Physical Properties:
 - a. Breaking Strength: 310 lbf typical; ASTM D 751, grab method.
 - b. Elongation at Break: 15 percent; ASTM D 751.
 - c. Tearing Strength: 100 lbf typical; ASTM D 751, Procedure B.

- d. Puncture Resistance: 300 lbs. typical, FTM 101B (Method 2031)
- e. Brittleness Point: Minus 22 deg F.
- f. Ozone Resistance: No cracks after sample, wrapped around a 3-inch-diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F and an ozone level of 100 pphm; ASTM D 1149.
- g. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F; ASTM D 573.
- h. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F; ASTM D 471.
- i. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204.
- j. Initial solar reflectance: 0.80 average, 0.65 minimum when tested per ASTM E903
- k. 3 Year Solar Reflectance: 0.70 average, 0.50 minimum when tested per ASTM E903
- l. Emissivity: at least 0.9 when tested in accordance with ASTM 408

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
- D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 - 1. Provide "third generation polyisocyanurate" product produced with pentane-based blowing agent, replacing conventional HCFC-141b blowing agent.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.

- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cover Board:
 - 1. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 - a. Product: Provide "Dens-Deck" by Georgia-Pacific Corporation.
 - b. Alternate products:
 - 1) Provide 1/2 inch thick HD polyiso cover board by Carlisle.
 - 2) Provide 1/4 inch thick Invisa Roof Board by Johns Manville.

2.6 VAPOR BARRIER

- A. Self adhered roof underlayment. Provide products from one of the following:
 - 1. Basis of Design: Blueskin Roof RF200 by Henry Company, 800-486-1278.
 - 2. Permashield by W. R. Grace & Co.
 - 3. Carlisle CCW 725 TR Air & Vapor barrier.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

2.8 METAL ROOF DRAINS

- A. Refer to Information on Drawings.
- B. Cast-Iron, Large-Sump, General-Purpose Roof Drains.:
 - 1. Standard: ASME A112.6.4, for general-purpose roof drains.
 - 2. Body Material: Cast iron.
 - 3. Outlet: Bottom.
 - 4. Underdeck Clamp: Required.
 - 5. Dome Material: PE.
 - 6. Perforated Gravel Guard: Stainless steel.
 - 7. Vandal-Proof Dome: Not required.
 - 8. Manufacturers: Josam, Smith, Zurn.
 - a. Josam Series 21500 is basis-of-design used as primary roof drain, large sump w/locking dome (galvanized); deck clamp, drain receiver and integral gravel stop.
- C. Emergency Overflow Scuppers:

1. Manufacturers: Josam, Smith, Zurn.
 - a. The Josam 25010 downspout nozzle is basis-of-design used as a parapet overflow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSTALLATION FOR VAPOR BARRIER

- A. Vapor Barrier: Install self-adhered membrane vapor barrier adhered directly to roof deck prior to the application of insulation and finished roof coverings.
 1. Apply vapor barrier in direction of slope or perpendicular to slope beginning at low point of and proceed in shingle fashion. Position sheet to achieve correct overlap and alignment.
 2. Flash vapor retarder to all penetrations with a collar of fiber glass felt sealed against retarder and penetration in roofing cement.

3.3 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.

- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

3.4 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 ROOF DRAIN INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Install expansion joints, where required, in roof drain outlets.
 3. Position roof drains for easy access and maintenance.

3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.10 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: **<Insert name of Owner.>**
 - 2. Address: **<Insert address.>**
 - 3. Building Name/Type: **<Insert information.>**
 - 4. Address: **<Insert address.>**
 - 5. Area of Work: **<Insert information.>**
 - 6. Acceptance Date: **<Insert date.>**
 - 7. Warranty Period: **<Insert time.>**
 - 8. Expiration Date: **<Insert 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 he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- 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. peak gust wind speed exceeding **<Insert wind speed>** mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. 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 **<Insert day>** day of **<Insert month>**, **<Insert year>**.
1. Authorized Signature: **<Insert signature.>**
 2. Name: **<Insert name.>**
 3. Title: **<Insert title.>**

END OF SECTION

SECTION 076000
METAL COPINGS, FASCIA, GUTTERS, AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Factory-formed and field-assembled, prefinished metal fascia

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data installation instructions and general recommendations for each fascia and coping product required. Include data substantiating that materials and performance comply with requirements.
- B. Samples: For initial selection of colors submit manufacturer's color charts consisting of small sections of the same metal to be used in the work which have been finished to indicate the full range and quality of standard colors or color ranges and of standard textures available.

PART 2 PRODUCTS

2.1 FABRICATION – GENERAL

- A. Provide fascia designed and fabricated to fit applications indicated and to perform optimally with respect to weather resistance, water tightness, durability, strength, and uniform appearance.
- B. Expansion Provisions: Fabricate fascia to allow controlled expansion in running lengths not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner which is sufficient to prevent water leakage, deformation or damage.

2.2 METAL FASCIA

- A. Provide the following manufacturers, but not limited to:
 - a. W. P. Hickman - EconoSnap Fascia (Basis of Design)
 - b. MetFab.
 - c. Architectural Products Co.
- B. ALUMINUM FINISHES
 - 1. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. For components which are assembled or welded in factory, apply finish after fabrication is completed.

2. Provide colors or color matches as indicated or if not indicated, as selected by Architect from manufacturer's standard colors.
3. High Performance Coating: AA-C12C42R1x (cleaned with inhibitive chemicals, conversion coated with an acid-chromate-fluoride-phosphate treatment and painted with organic coating specified below). Apply in strict compliance with coating and resin manufacturer's instructions using a licensed applicator. Inhibitive thermo-cured primer, 0.2 min. mil dry film thickness, and thermo-cured fluorocarbon coating containing "Kynar 500" resin, 1.0 mil min. dry film thickness.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions and recommendation. Coordinate with installation of roof deck and other substrates to receive work of this section, with vapor barriers, roof insulation, roofing membrane, flashing, and wall construction; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor products included in this section securely to structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.
- B. Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by aluminum producer.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings.
- B. Protection: Provide protective measures as required to ensure that work of this section will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 076200
FLASHING, SHEET METAL AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes flashings and counterflashings, and fabricated sheet metal items as indicated.

1.2 REFERENCES

- A. AAMA 603.8 (American Architectural Manufacturers Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- B. AAMA 611 (American Architectural Manufacturers Association) - Standards for Anodized Architectural Aluminum.
- C. ASTM A924/A924M - Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot-Dip Process, Structural Physical Quality.
- D. ASTM A653/A653M - Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated by the Hot-Dip Process.
- E. ASTM B209/B209M – Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- F. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) - Architectural Sheet Metal Manual.

1.3 DESIGN REQUIREMENTS

- A. Sheet Metal Flashings: Conform to the criteria of SMACNA "Architectural Sheet Metal Manual."

1.4 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- B. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.
- C. Samples:
 - 1. Submit two samples, 4 x 4 inch in size of each type of sheet metal illustrating finish and/or color.

1.5 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal work with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

- A. Aluminum Sheet: ASTM B209/B209M, 3003 alloy, H-14 temper, alloy and temper as required for application and finish; 0.032 inch thick; Kynar 500 coating to match adjacent aluminum components.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Solder: For use with steel, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.
- B. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- C. Bituminous Coating: FS TT-C-494 or SSPC – Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- D. Mastic Sealant: Polyisobutylene: non-hardening, non-skinning, non-drying, non-migrating sealant.
- E. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
- F. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- G. Paper Slip Sheet: 5-lb rosin-sized building paper.
- H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

- I. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- J. Roofing Cement: As recommended by roofing manufacturer.

2.5 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet metal, interlocking with sheet.
- C. Form pieces in longest possible lengths, not less than 12'-0".
- D. Hem exposed edges on underside ½ inch; miter and seam corners.
- E. Form material with standing or flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed straight, held away from substrate ¼ inch and hemmed to form drip.
- H. Seal metal joints.

2.6 FACTORY FINISHING- (Exposed Locations)

- A. Fluoropolymer (Kynar) coating: Baked enamel system conforming to 15% reflective gloss (ASTM D523).
- B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.2 INSTALLATION REQUIREMENTS

- A. General Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed Flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install counter-flashing to thru-wall flashing by snap-in seal arrangement.
- E. Provide end dams at all discontinuous ends.
- F. Lap all flashing 6 inches at joints, seal laps with compatible joint sealants and mastic.
- H. Apply plastic cement compound between metal flashings and felt flashings.
- I. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- J. Seal metal joints watertight.

END OF SECTION

SECTION 077200
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.
4. Pipe and duct supports.
5. Pipe portals.
6. Preformed flashing sleeves.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Delegated Design Submittals: For roof curbs equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.

2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 1. Size and location of roof accessories specified in this Section.
 2. Method of attaching roof accessories to roof or building structure.
 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories to 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.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design roof curbs and equipment supports to comply

with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- C. Wind-Restraint Performance: As indicated on Drawings .

2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AES Industries, Inc.
 - b. Custom Solution Roof and Metal Products, a division of Colony Heating.
 - c. KCC Manufacturing.
 - d. Louvers & Dampers, Inc.; Mestek, Inc.
 - e. Metallic Products Corporation.
 - f. Pate Company (The).
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported .
- D. Steel: Zinc-coated (galvanized) steel sheet, 0.052 inch thick.
 - 1. Finish: Mill phosphatized .
- E. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 8 inches above roofing surface unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
 - 5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 - 6. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.

8. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
12. Security Grille: Provide where indicated.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AES Industries, Inc.
 - b. KCC Manufacturing.
 - c. Pate Company (The).
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported .
- D. Steel: Zinc-coated (galvanized) steel sheet, 0.052 inch thick.
 1. Finish: Factory prime coating .
- E. Construction:
 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 4. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
 5. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 6. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.

7. Fabricate equipment supports to minimum height of 8" above roofing surface unless otherwise indicated.
8. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
9. Security Grille: Provide where indicated on Drawings.

2.4 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACUDOR Products, Inc.
 - b. AES Industries, Inc.
 - c. Architectural Specialties, Inc.
 - d. Babcock-Davis.
 - e. BILCO Company (The).
 - f. Dur-Red Products.
 - g. JL Industries; Activar Construction Products Group, Inc.
 - h. KCC Manufacturing.
 - i. Kingspan Light + Air LLC.
 - j. Lexcor; a division of Luxsoco corp.
 - k. Metallic Products Corporation.
 - l. Milcor by Duravent; Duravent Group.
 - m. Nystrom, Inc.
 - n. O'Keeffe's Inc.
 - o. Pate Company (The).
 - p. Precision Ladders, LLC.
 - q. Williams Brothers Corporation of America.
- B. Type and Size:
 1. Single-leaf lid, 36 x 36 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material, Steel: Zinc-coated (galvanized) steel sheet.
 1. Thickness: Manufacturer's standard thickness for hatch size indicated .
 2. Finish: Baked enamel or powder coat .
 3. Color: As selected by Architect from manufacturer's full range .
- E. Construction:

1. Insulation: 1-inch- thick, cellulosic-fiber board .
 - a. R-Value: 4.3 according to ASTM C1363.
 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 3. Hatch Lid: Opaque , insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Height: 42 inches above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 7. Fabricate joints exposed to weather to be watertight.
 8. Fasteners: Manufacturer's standard, finished to match railing system.
 9. Finish: Manufacturer's standard .
 - a. Color: As selected by Architect from manufacturer's full range .
- H. 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 .
 4. Post: 1-5/8-inch- diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat .
 - a. Color: As selected by Architect from manufacturer's full range .

2.5 PIPE AND DUCT SUPPORTS

- A. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; accommodating up to 7-inch- diameter

pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.

- B. Curb-Mounted Pipe Supports: Galvanized steel support with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-bearing pipe support accommodating up to 20-inch- diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
- C. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
 - 1. Finish: Manufacturer's standard .

2.6 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless steel snaplock swivel clamps.

2.7 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products, a division of Colony Heating.
 - b. Menzies Metal Products.
 - c. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - 3. Diameter: As indicated on Drawings .
 - 4. Finish: Manufacturer's standard .
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products, a division of Colony Heating.
 - b. Menzies Metal Products.
 - c. Milcor by Duravent; Duravent Group.
 - d. Thaler Metal Industries Ltd.
2. Metal: Aluminum sheet, 0.063 inch thick .
3. Height: 7 inches .
4. Diameter: As indicated on Drawings .
5. Finish: Manufacturer's standard .

2.8 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
 2. 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.
- B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.
- C. Steel Tube: ASTM A500/A500M, round tube.
- D. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- E. Steel Pipe: ASTM A53/A53M, galvanized.

2.9 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- C. 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.
- D. Security Grilles: 3/4-inch diameter, ASTM A1011/A1011M steel bars spaced 6 inches o.c. in one direction and 12 inches o.c. in the other; factory finished as follows:

1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 3. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- F. Underlayment:
1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D4397.
 3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- H. 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.
- I. Elastomeric Sealant: ASTM C920, elastomeric 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.
- J. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

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. 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. 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, 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. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.

- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Preformed Flashing-Sleeve and Flashing-Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- G. Security Grilles: Weld bar intersections and , using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.
- H. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078413
THROUGH-PENETRATION FIRESTOP SYSTEMS

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 through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
 - 1. Fire-resistance-rated walls including fire walls smoke barriers.
 - 2. Fire-resistance-rated horizontal assemblies including floor/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.
- D. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing

- testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined

by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated, that are produced by one of the following manufacturers:
1. A/D Fire Protection Systems Inc.
 2. Grace, W. R. & Co. - Conn.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. NUCO Inc.
 7. RectorSeal Corporation (The).
 8. Specified Technologies Inc.
 9. 3M; Fire Protection Products Division.
 10. Tremco; Sealant/Weatherproofing Division.
 11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Through-penetration firestop system manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078446
FIRE-RESISTIVE JOINT SYSTEMS

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 fire-resistive joint systems for the following:
 - 1. Head-of-wall joints.
 - 2. Wall-to-wall joints.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities indicated as determined by UL 2079.
 - 1. Load-bearing capabilities as determined by evaluation during the time of test.
- C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

- D. Qualification Data: For Installer.
- E. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
- F. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Fire-Resistive Joint System Schedule at the end of Part 3.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.5 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
- B. Head-of-Wall Fire-Resistive Joint Systems FRJS- A:
 - 1. Available UL-Classified Systems: HW-D-0045 -.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: $\frac{3}{4}$ ".
 - 4. Movement Capabilities: Class - 33% percent compression or extension.
- C. Wall-to-Wall Fire-Resistive Joint Systems FRJS- B:
 - 1. Available UL-Classified Systems: WW-D -0032.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 1".
 - 4. Movement Capabilities: Class II - 12 percent compression or extension.

END OF SECTION

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 joint sealants for the following applications:
 - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between metal panels.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - g. Control and expansion joints in ceilings and other overhead surfaces.
 - h. Other joints as indicated.
 - 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
 - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
 - d. Other joints as indicated.
 - 4. Interior joints in the following horizontal traffic surfaces:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type 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. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer.
- F. Field Test Report Log: For each elastomeric sealant application.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT 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. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees 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.

- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 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.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 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 sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric 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.

- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral- and Basic-Curing Silicone Sealant :
1. Available Products:
 - a. Tremco; Spectrem 1 (Basic).
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 100/50.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
1. Available Products:
 - a. Pecora Corporation; 898.
 - b. Tremco; Tremsil 600 White.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: ceramic tile .
- F. Multicomponent Nonsag Urethane Sealant :
1. Available Products:
 - a. Pecora Corporation; Dynatrol II.
 - b. Tremco; Dymeric 511.
 - c. Tremco; Vulkem 922.
 2. Type and Grade: M (multicomponent) and NS (nonsag).
 3. Class: 50.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
- G. Multicomponent Nonsag Urethane Sealant :
1. Available Products:
 - a. Schnee-Morehead, Inc.; Permathane SM 7200.
 - b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
 - c. Sonneborn, Division of ChemRex Inc.; NP 2.
 - d. Tremco; Vulkem 227.

- e. Tremco; Vulkem 322 DS.
 - 2. Type and Grade: M (multicomponent) and NS (nonsag).
 - 3. Class: 25.
 - 4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: aluminum coated with a high-performance coating brick.
- H. Single-Component Nonsag Urethane Sealant :
- 1. Available Products:
 - a. Sika Corporation, Inc.; Sikaflex - 1a.
 - b. Sonneborn, Division of ChemRex Inc.; Ultra.
 - c. Sonneborn, Division of ChemRex Inc.; NP 1.
 - d. Tremco; Vulkem 116.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 25.
 - 4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. Available Products:
 - 1. Bostik Findley; Chem-Calk 600.
 - 2. Pecora Corporation; AC-20+.
 - 3. Schnee-Morehead, Inc.; SM 8200.
 - 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
 - 5. Tremco; Tremflex 834.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type 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: ASTM C 1330, Type C (closed-cell material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F . Provide products with low

compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

- D. 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.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting 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, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
- 3. Remove laitance and form-release agents from concrete.
- 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended 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.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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 that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform 1 test for each of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
 4. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

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. Section Includes:
 - 1. Standard hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Other Action Submittals:
 - 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.

- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 257 or UL 10C.
- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.
 - 4. Curries Company; an Assa Abloy Group company.
 - 5. Deansteel Manufacturing Company, Inc.
 - 6. Firedoor Corporation.
 - 7. Fleming Door Products Ltd.; an Assa Abloy Group company.
 - 8. Habersham Metal Products Company.
 - 9. Karpen Steel Custom Doors & Frames.
 - 10. Kewanee Corporation (The).
 - 11. Mesker Door Inc.
 - 12. Pioneer Industries, Inc.
 - 13. Security Metal Products Corp.
 - 14. Steelcraft; an Ingersoll-Rand company.
 - 15. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- 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 C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD 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: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors.
 - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
 - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.

6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
- 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. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD 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 steel sheet.
 1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as knocked down or face welded unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as knocked down or face welded unless otherwise indicated.
 3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
 4. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
 5. Frames for Wood Doors: 0.053-inch- thick steel sheet.
 6. Frames for Borrowed Lights: 0.053-inch- thick steel sheet, same as adjacent door frame.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less

than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.9 ACCESSORIES

- A. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. 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.
- 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 Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 6. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - 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. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- 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 nontemplated, mortised and surface-mounted door hardware.
 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 with Division 16 Sections.
- G. 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.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. 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 nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. 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 or mortar.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. 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.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection and prior to 1 year warranty date after substantial completion. 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

SECTION 082113
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. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 - 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
 - 3. Louver blade and frame sections, 6 inches long, for each material and finish specified.

4. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Algoma Hardwoods, Inc.
2. Buell Door Company Inc.
3. Chappell Door Co.
4. Eagle Plywood & Door Manufacturing, Inc.
5. Eggers Industries.
6. Graham.
7. Ideal Architectural Doors & Plywood.
8. Ipik Door Company.
9. Lambton Doors.
10. Marshfield Door Systems, Inc.
11. Oshkosh Architectural Door Company.
12. Vancouver Door Company.
13. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.

- B. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

- C. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- E. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware and as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 4-1/2-by-10-inch lock blocks 5-inch midrail blocking, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors :

1. Grade: Premium, with Grade A faces.
2. Species to be select by Architect from following: Select white maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Bookmatch.
5. Assembly of Veneer Leaves on Door Faces: Runningmatch.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Transom Match: Continuous match.
8. Exposed Vertical and Top Edges: Same species as faces
9. Core: Either glued wood stave or structural composite lumber.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
11. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
- B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane.
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 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.
- 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. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering

unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

- a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting 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 that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- D. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors and frames.
 - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babcock-Davis; A Cierra Products Co.
 - 2. Bar-Co, Inc. Div.; Alfab, Inc.
 - 3. Dur-Red Products.
 - 4. J. L. Industries, Inc., as standard of quality use Model TM and FD for fire-rated.
 - 5. Nystrom, Inc.
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
 - 1. Locations: Masonry wall surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with exposed face flange of frame.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch- or 1-1/4-inch- wide, manufacturer's standard, surface-mounted trim.
 - 4. Hinges: Spring-loaded, concealed-pin type or Continuous piano, manufacturer's standard.
 - 5. Lock: Cylinder.
- C. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
 - 1. Locations: Gypsum board wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.

3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 4. Hinges: Spring-loaded, concealed-pin type or Continuous piano, manufacturer's standard.
 5. Lock: Cylinder.
- D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Masonry wall surfaces.
 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
 5. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch- or 1-1/4-inch- wide, manufacturer's standard, surface-mounted trim.
 6. Hinges: Spring-loaded, concealed-pin type or Continuous piano, manufacturer's standard.
 7. Automatic Closer: Spring type.
 8. Lock: Self-latching device with cylinder lock.
- E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
1. Locations: Gypsum board wall and ceiling surfaces.
 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
 5. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 6. Hinges: Spring-loaded, concealed-pin type or Continuous piano, manufacturer's standard.
 7. Automatic Closer: Spring type.
 8. Lock: Self-latching device with cylinder lock.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083454
BULLET RESISTANT STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-rated Bullet-resistant pressed steel frames.
- B. Non-rated Bullet-resistant pressed steel doors.
- C. Bullet resistant steel frames.
- D. Bullet-resistant glazing.

1.2 REFERENCES

- A. ASTM A653/A653M-15el - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. AWS D1.1/D1.1M:2015, Structural Welding Code - Steel.
- C. HMMA 802-07 - Manufacturing of Hollow Metal Doors and Frames.
- D. HMMA 840-16 - Installation and Storage of Hollow Metal Doors and Frames.
- E. HMMA 841-13 - Tolerances and Clearance for Commercial Hollow Metal Doors and Frames.
- F. ULC 752-05 republished 12\2015 - Standard for Bullet Resisting Equipment.

1.3 PERFORMANCE REQUIREMENTS

- A. Bullet Resistance: Conform to UL 752, Level 3

1.4 SUBMITTALS

- A. Product Data: Provide product data on door construction and glazing.
- B. Shop Drawings: Indicate door and frame elevations, internal reinforcement, anchor types, closure methods, finishes, location of cut-outs for hardware, and cut-outs for glazing.

1.5 QUALITY ASSURANCE.

- A. Doors and frames manufactured by same firm.

1.6 DELIVERY, STORAGE AND PROTECTION

- A. Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

- B. Store in vertical position, spaced with blocking to permit air circulation between components.
- C. Store materials out of water and covered to protect from damage.
- D. Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

1.7 WARRANTY

- A. Manufacturer's Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

Part 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include the following:
 - 1. AMBICO Limited
 - 2. Armortex
 - 3. Republic Doors and Frames
 - 4. Insulgard
 - 5. Curries

2.2 MATERIALS

- A. Sheet Steel: Galvanized steel to ASTM A653/A653M, ZF75 minimum 1.5 mm.
- B. Bullet-Resistant Composite: UL Listed Bullet Resistant Composite of UL level equal to specified door and frame ballistic protection level.
- C. Ballistic Steel: Hi-Hard Ballistic Steel, of UL Ballistic Level equal to specified door and frame

2.3 ACCESSORIES

- A. Hinges: Heavyweight butt type or continuous hinge type by door supplier.
- B. Glazing Stops: Formed galvanized steel channel, mitred corners; prepared for countersink style tamperproof screws.
- C. Glass: Type as tested to achieve ballistic ratings.
- D. Primer: Rust inhibitive zinc phosphate.

- E. Astragal: To be supplied loose ready for field assembly by others. Astragal will comply with the bullet resistant rating of the entire assembly.
- F. Removable Mullion: To be provided at paired openings, where occasional access is required. Mullion will comply with the bullet resistant rating of the entire assembly.

2.4 FABRICATION

- A. Manufacture doors and frames to Level 3 bullet resistance rating in accordance with UL 752.

- B. Steel Doors:

- .1 Sheet steel faces, thickness, design, and core suitable to achieve specified ballistic performance.
- .2 Laminated core construction, longitudinal edges welded, filled and sanded with no visible edge seams.
- .3 Drill and tap for mortised, templated hardware.
- .4 Top and Bottom Channels: Inverted, recessed, welded steel channels.
- .5 Astragals: Metal T shaped astragals for double doors.
- .6 Weld hardware reinforcement plates in place.
- .7 Fabrication Tolerances: To HMMA 841.

- C. Steel Frames:

- .1 Sheet steel, metal thickness and appropriate to maintain bullet resistant door and frame ratings, mitred corners.
- .2 Factory assemble and weld frames.
- .3 Mullions for Double Doors: Removable type.
- .4 Drill and tap for mortised, templated hardware.
- .5 Reinforce frames wider than 1200 mm (48 inches) with roll formed steel channels welded tightly into frame head, flush with top.
- .6 Provide three single silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.
- .7 Fabrication Tolerances: To HMMA 841.

- D. Factory installed glazing: shall be in conformance with bullet resistant rating of door and frame assembly.

- E. Affix permanent metal nameplates to door and frame, indicating manufacturer's name, door tag, model number, and ballistic rating.

2.5 FINISHES

- A. Factory Finish: Factory applied zinc phosphate primer to be applied to all exposed surfaces.

2.6 INSTALLATION

- A. Install components to manufacturer's written instructions.
- B. Install doors and frames to HMMA 840 standards.
- C. Coordinate with masonry wall construction for anchor placement.
- D. Set frames plumb, square, level and at correct elevation.
- E. Install factory supplied glazing to frames.
- F. Allow for deflection to ensure that structural loads are not transmitted to frame.
- G. Adjust operable parts for correct clearances and function.
- H. Finish paint in accordance with Section 09 91 00.

2.7 ERECTION TOLERANCES

- A. Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than $\pm 1/16$ in (1.5mm) in compliance with HMMA 841.

2.8 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 084113
ALUMINUM-FRAMED ENTRANCES, STOREFRONTS AND CURTAINWALL

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 and Interior aluminum-framed storefronts
 - a. Glazing is retained mechanically with gaskets on four sides
 - 2. Exterior aluminum-framed curtainwall.
 - a. Glazing is retained mechanically with gaskets on four sides
 - 3. Exterior and Interior manual-swing aluminum doors
 - 4. Exterior and Interior aluminum door frames
 - 5. Interior door frames for wood doors as noted on the door schedule

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
 - 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units to function properly.
- B. Structural Loads:
 - 1. Refer to Drawing S001 "Structural General Notes" for design loads.
- C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13'-6" and to 1/240 of clear span plus 1/4" for spans greater than 13'-6" or an amount that restricts edge deflection of individual glazing lites to 3/4", whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8", whichever is smaller.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% of span.
 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Test Low Exterior Ambient-Air Temperature: 0 degrees F.
 - c. Test Interior Ambient-Air Temperature: 75 degrees F.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq ft of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq ft.
- G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 8 psf as defined in AAMA 501.
- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than: glass to ext 70 and 69 glass, glass to center 62 frame and 68 glass and glass to interior 56 frame and 67 glass when tested in accordance with AAMA 1503.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
 2. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
- E. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Accessible Entrances: Comply with the "Americans Disability Act" (ADA)

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product - Storefront: The design for aluminum-framed systems, front glazed, 2" x 4- 1/2" thermally broken for exterior frames and center glazed, 2" x 4 1/2" non thermal system at interior frames. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Kawneer – 451T exterior / 450 interior (basis of design)
 - 2. EFCO
 - 3. YKK AP America Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B209
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429
 - 4. Structural Profiles: ASTM B 308/B 308M
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 8 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 DOORS

- A. Doors: Manufacturer's standard glazed doors, for manual swing operation.
 - 1. Door Construction: 1 3/4" thickness with a minimum wall thickness of 0.125", extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Manufacturers medium stile door with a 12" bottom rail.
 - 3. Glazing Stops and Gaskets: Square or beveled (mfg std.), snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
 - 1. Opening-Force Requirements:
 - a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf.
- B. Scheduled Door Hardware: Provide door hardware according to the Door Hardware as Scheduled in Division 8 Section "Door Hardware" unless noted otherwise.
- C. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- D. Pushes and Pulls: 1" dia., brushed aluminum, full width of door, where indicated in the door hardware schedule. There shall be two per door leaf per side when used as either pushes or pulls and shall be "stacked" approximately 6" o.c. vertically. Architect shall verify final vertical spacing dimension. With a pair of doors having exit devices there will be four pulls on the exterior. Interior doors without panic hardware will have a total of four push bars on the interior and four pulls on the exterior.
- E. Weather Stripping: Manufacturer's standard replaceable components, where indicated in the door hardware schedule.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- F. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip, finish shall match door.
- G. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm), manufacturers standard.

2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mil thickness per coat.
- C. Stainless Steel Stand-Offs:
 - 1. Diameter: 3/4"
 - 2. Standoff: 2 1/2"
 - 3. Stainless Steel: Satin Finish

2.8 FABRICATION

- A. Form aluminum shapes before finishing.

- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from interior.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- D. Storefront Framing: Fabricate components for assembly using either a shear block or screw spline system.
- E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware. Note that this also applies to those frames that will have both doors and hardware provided under other sections. (i.e. wood doors in aluminum frames.) These interior frames shall be prepared for hardware as specified under Section 8 "Hardware".
 - 1. At exterior and interior doors, provide compression weather stripping at fixed stops.
- F. Doors: Reinforce doors as required for installing hardware.
 - 1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Aluminum Finish: Clear Anodized at all locations unless noted otherwise
- D. Aluminum Finish on doors at Opening V201: Selected from manufacturers' standard range of architectural painted color coatings to match existing frames to remain. Basis of design – Kawneer Permafluor or approved Equal.

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 work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight, unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, without warp or rack.
- F. Install glazing as specified in Division 8 Section "Glazing."
- G. Entrances: Install to produce smooth operation and tight fit at contact points.
 - 1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
 - 2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.
- I. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8" in 12'-0"; 1/4" over total length.
2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16".
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32".
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8".

3.3 ADJUSTING

- A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

END OF SECTION

SECTION 085653
SECURITY WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed, transaction security windows.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
 - 1. Workmanship Warranty: All materials shall be warranted against defects for a period of [1] year for the date of receipt at the project site. Provide certificates of manufacturer's standard limited warranty with closeout documents.
 - 2. Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for the period of [5] years from the 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, UL 752: Level 3 in accordance with UL 752.

2.2 FIXED, TRANSACTION SECURITY WINDOWS

- A. Provide fixed, transaction security windows with operable sash or ventilator capable of allowing transfer of currency and documents.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armortex.
 - b. C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - c. Chicago Bullet Proof Systems.
 - d. Creative Industries, Inc.
 - e. Krieger Specialty Products Company.
 - f. National Bullet Proof, Inc.
 - g. Norshield Security Products, LLC.
 - h. Overly Door Company.
 - i. Protective Structures, Ltd.
 - j. Quikserv, Inc.
 - k. Ready Access.
 - l. Ross Technology Company.
 - m. SABIC Innovative Plastics IP BV.
- B. Configuration: One fixed-glazed panel with speak hole and backer window.
- C. Framing: Fabricate perimeter framing, mullions, and glazing stops from steel or aluminum as follows:
 - 1. Profile: with minimum face dimension indicated.
 - 2. Depth: Manufacturer's standard.
- D. Head and Jamb Framing: Designed for sealant glazing gasket glazing.
- E. Channel-Frame Sill: Formed from stainless steel and designed for sealant glazing.
- F. Glazing and Glazing Materials:
 - 1. Ballistic Resistant:
 - a. Level 3 in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.
 - b. 1 1/4" LP 1250 Laminated
 - c. Glazing gaskets:
 - d. Interior: Closed cell neoprene.
- G. Glazing Meeting Edges: Polished glazing.

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 attack side of framing.
 2. Prepare security windows for field glazing unless preglazing at the factory is indicated.
- B. 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.
- C. Glazing Stops: Finish glazing stops to match security window framing.
1. Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.
 2. Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
- D. 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.
- E. Factory-cut openings in glazing for speaking apertures.
- F. Weather Stripping: Factory applied.

2.4 FINISHES

- A. Factory-applied finish:
1. Clear Anodic Finish: Architectural Class I, clear coating AA-M10C22A41
Mechanical Finish Chemical Finish: etched, medium matte; 0.70 mils minimum complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum"

2.5 STAINLESS STEEL FINISHES

- A. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Directional Satin Finish: ASTM A480/A480M, No. 4.
- B. Speaking Apertures: Fabricate from 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 in accordance with UL 752.
- C. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

- D. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch thick; with minimum 1/2-inch-diameter, headed studs welded to back of plate.
- E. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- F. Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric backing.
- G. 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.
- H. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B633; provide sufficient strength to withstand design pressures indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

3.2 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.
- B. Glazed Framing: Provide sealant gasket-glazed framing. Comply with installation requirements in Section 088853 "Security Glazing."
- C. Removable Glazing Stops and Trim: Fasten components with security fasteners.
- D. 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.

END OF SECTION

SECTION 087100 DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

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

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

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

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule

- e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
- f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

- 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

- 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
- 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
- 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
- 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

- 1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105

- b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 - 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 - 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
- 1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 - 2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 - 3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 3 years
 - b) Schlage ND Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - 4) Automatic Operators
 - a) LCN: 2 years
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 3 years
 - 2) Exit Devices
 - a) Von Duprin: 3 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.

3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. McKinney TB series
 - b. Best FBB series

B. Requirements:

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

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. ABH

b. Select

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. ABH PT1000
 - b. Security Door Controls PTM

B. Requirements:

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

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

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

2.07 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.08 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. Sargent 8200 series
 - b. Corbin-Russwin ML2000 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

- a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
 - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
- a. Lever Design: 06A (RHO).

2.09 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
- 2. Acceptable Manufacturers and Products:
 - a. Sargent 11-Line
 - b. Corbin-Ruswin CL3100 series
 - c. Falcon TM series

B. Requirements:

- 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
- 2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
- 3. Cylinders: Refer to "KEYING" article, herein.
- 4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
- 5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
- 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
- 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
- 8. Provide electrified options as scheduled in the hardware sets.
- 9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

- a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
- b. Lever Design: Rhodes (RHO).

2.10 DEADBOLTS

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. Schlage B600/B700/B800 Series
- 2. Acceptable Manufacturers and Products:
 - a. Sargent 480 Series
 - b. Corbin-Russwin DL3000 Series
 - c. Falcon D100 Series

B. Requirements:

- 1. Provide grade 1 deadbolt series conforming to ANSI/BHMA A156.
- 2. Cylinders: Refer to "KEYING" article, herein.
- 3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
- 4. Provide manufacturer's standard strike.
- 5. Lock Status Indicator Trim: Where specified, provide escutcheon with lock status indicator widow.
 - a. Escutcheon height 4.125 inches, width 2.54 inches. Projection 1.32 inches on thumbturn side and 1.28 inches on cylinder side.
 - b. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Indicator window to provide 180-degree visibility.

2.11 EXIT DEVICES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series
- 2. Acceptable Manufacturers and Products:
 - a. Detex Advantex series
 - b. Precision APEX 2000 series

B. Requirements:

- 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
- 2. Cylinders: Refer to "KEYING" article, herein.
- 3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
- 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.

5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices at pool gates with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Provide exit devices with manufacturers' approved strikes.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.12 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
 - a. Dynalock 5000 series
 - b. Security Door Controls 600 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.

- I. High voltage protective cover.

2.13 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage Everest 29 T
2. Acceptable Manufacturers and Products:
 - a. Sargent DG2
 - b. Corbin-Russwin Patented and Restricted Keyway

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Restricted: cylinder with interchangeable core with patented, restricted keyway.
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.14 KEYING

A. Scheduled System:

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:

- 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
- 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
- 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
- d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.15 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Telkee
2. Acceptable Manufacturers:
 - a. HPC
 - b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.16 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4010/4110/4020 series
2. Acceptable Manufacturers and Products:
 - a. Norton 9500 series
 - b. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.17 MAGNETIC HOLD-OPENS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. LCN SEM7800 Series
2. Acceptable Manufacturers:
 - a. Norton
 - b. Rixson

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation

2.18 ELECTROMECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN Senior Swing 9500IQ Surface Mounted and 2800IQ Concealed Series

2. Acceptable Manufacturers and Products:
 - a. Besam Swingmaster SW200I
 - b. Stanley Access Technologies M-Force

B. Requirements:

1. Electro-mechanical, handed low energy automatic operator, as defined by ANSI/BHMA standard A156.19.
 - a. Automatic operator shall be capable of operating and controlling up to a 600-pound (272.15 kg) door, 48 inches (1219 mm) in width
 - b. Operator shall be activated via push button, push plate, switch-activated, manual or field-programmable manual/electric power with power assist and push and go opening capabilities compliant with ANSI A156.19.
 - c. Calibration cycle: Operator will automatically configure a default for the user-adjustable features by determining the physical aspects of the door and opening area.
 - d. Operator shall include individual connections for both fire / breakaway and blow open / hold open functionality, in addition to a short-term battery backup for proper functionality during power loss.
2. Surface-applied mounting: On surface of door frame/wall, mounted above top of door.
 - a. Provide base mounting plate and mounting brackets allowing for simplified hook-and-cleat type of installation.
 - b. Provide drop plates, brackets, cast arms, and adapters for arms as required to suit details.
 - c. Tamper-resistant "Off/Auto/Hold-Open" switch to be provided on the device.
 - d. Provide motion sensors and/or actuator switches, and receivers for operation as specified.
 - e. Provide weather-resistant actuators at exterior applications.
 - f. Provide key switches recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
 - g. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf.
 - h. Actuators control both doors simultaneously [9550IQ] or independently [9560IQ] at pairs.
 - i. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect.
 - j. Locate actuators, key switches, and other controls as directed by Architect.
3. Overhead concealed mounting: Integrated into frame system, mounted 1/8" above top of door.
 - a. Provide mounting header allowing for bottom loaded installation for easy access to controls.
 - b. Provide forged steel arm and slide track for top of door
 - c. Provide brackets and adapters for arms as required to suit details.
 - d. Provide motion sensors and/or actuator switches, and receivers for operation as specified.
 - e. Provide weather-resistant actuators at exterior applications.
 - f. Provide key switches recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
 - g. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf.

- h. Actuators control both doors simultaneously [2850] or independently [2860] at pairs.
 - i. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect.
 - j. Locate actuators, key switches, and other controls as directed by Architect.
 - k. Where operating a center pivoted inswinging door serving as a means of egress, provide breakaway switch to allow door to swing outward and automatically reset when returned to the closed position.
- 4. Finish of exposed headers: Anodized aluminum, dark bronze anodized, or anodized black – as specified in hardware sets.

2.19 DOOR TRIM

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

- 1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.20 DOOR TRIM

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Trimco
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Ives

B. Requirements:

- 1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.21 PROTECTION PLATES

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.22 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. Rixson
 - b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.23 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.24 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Steelcraft

b. Republic

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.25 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Scheduled Manufacturer:

1. Zero International

B. Acceptable Manufacturers:

1. National Guard
2. Reese

C. Seals and Gasketing: Provide continuous gasketing on exterior openings, to the head and jambs, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.

1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames.
 - a. Provide non-corrosive fasteners for all exterior applications.
 - b. Provide security fasteners where indicated.
2. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

D. Smoke Labeled Gasketing: At all smoke labeled openings, provide smoke listed perimeter gasketing assemblies complying with NFPA 105 listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for smoke control ratings indicated based on testing according to UL 1784.

E. Fire Listed Gasketing: Assemblies complying with NFPA 80 that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction for fire ratings indicated based on testing according to UL-10C.

1. Where frame-applied intumescent seals are required by the manufacturer, provide gaskets that comply with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2, Fire Tests of Door Assemblies.

F. Sound-Rated Gasketing: Provide acoustic gasketing to meet Sound Transmission Class (STC) rating required.

G. Meeting-Stile Gasketing: Provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.

H. Door Sweeps or Shoes: Apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.

1. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- I. Automatic Door Bottoms:
 1. Provide closed cell sponge, bulb neoprene. or EPDM type of seal as specified in hardware sets.
 2. Door bottom to be mortised, semi mortised, or surface mount as with a minimum thickness as specified in hardware sets.
 - J. Rain Drips:
 1. Provide overhead rain drips for out-swinging hollow metal doors that are not covered against 45 degree blowing rain. Aluminum extrusion to be a minimum of .088 inches thick and extend 2.50 inches from the face of the frame, in anodized finish to match door.
 2. Door sweeps or shoes with integral rain drip must meet ADA requirements
 - K. Thresholds: Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, and fabricated to accommodate door hardware and fit door frames.
 1. Threshold extrusion to be a minimum thickness as specified in hardware sets.

2.26 MAGNETIC HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. LCN
 2. Acceptable Manufacturers:
 - a. Rixson
 - b. Sargent
- B. Requirements:
 1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.27 DOOR POSITION SWITCHES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Schlage
 2. Acceptable Manufacturers:
 - a. GE-Interlogix
 - b. Sargent
- B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.28 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- P. Thresholds:
 - 1. Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
 - 2. Aluminum thresholds to be cut-in, and scribed around mullions, frame members, and stops. Do not butt to thresholds. Provide a continuous surface across full width of opening from jamb to jamb.

3. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, undercut doors as required to properly mate with seal in threshold.
- Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- R. Perimeter Gasketing:
1. Apply to head and jamb, forming seal between door and frame.
 2. Install gasketing in a manner eliminating need to cut any seal to install surface mounted hardware. Install compatible mounting bracket for surface mounted hardware unless minimum 1/4 inch thick solid aluminum seals are provided for mounting of surface applied hardware.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE







- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Legend:

-  Link to catalog cut sheet
 Electrified Opening






Hardware Group No. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE







Hardware Group No. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE







Hardware Group No. 03A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER







Hardware Group No. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE












Hardware Group No. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER

Hardware Group No. 06







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO RX CON 12V/24V DC		✂ 626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, DOOR TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.







Hardware Group No. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
3	EA	SILENCER	SR64		GRY	IVE





Hardware Group No. 08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE







Hardware Group No. 08A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PUSH/PULL BAR	9190EZHD-10"-NS		630	IVE
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE












Hardware Group No. 09

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	OH STOP & HOLDER	90H		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 11







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO RX CON 12V/24V DC		✂ 626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, DOOR TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.












Hardware Group No. 13

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	GASKETING	488SBK		BK	ZER

Hardware Group No. 15












Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO RX CON 12V/24V DC		✂ 626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, DOOR TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 16







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO RX CON 12V/24V DC	 ⚡	626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)	 ⚡	BLK	SCE
1	EA	DOOR CONTACT	679-05HM	 ⚡	BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC	 ⚡	LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, DOOR TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.









Hardware Group No. 17

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	98-L-BE-06		626	VON
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE











Hardware Group No. 18

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	MORTISE DEADLOCK	MS1850SN		628	ADA
2	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
2	EA	FSIC CORE	23-030		626	SCH
2	EA	INDICATOR	4089		628	ADA
1	EA	PUSH/PULL BAR	9190EZHD-10"-NS		630	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 SRT		689	LCN
1	EA	BLADE STOP SPACER	4110-61 SRT		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER











Hardware Group No. 19

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	CLASSROOM DEADBOLT	B663T		626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	THE ULTIMATE RESTROOM PULL	1835-3		630	TRM
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	ARMOR PLATE	8400 36" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		BLK	IVE
1	EA	WALL STOP/HOLDER	WS45X		626	IVE
3	EA	SILENCER	SR64		GRY	IVE









Hardware Group No. 20

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM DEADBOLT	B663T		626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	THE ULTIMATE RESTROOM PULL	1835-3		630	TRM
1	EA	OH STOP & HOLDER	90H		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	ARMOR PLATE	8400 36" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE










Hardware Group No. 21

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
2	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURFACE CLOSER	4111 SHCUSH		689	LCN
3	EA	SILENCER	SR64		GRY	IVE











Hardware Group No. 22

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
2	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	WALL STOP/HOLDER	WS45X		626	IVE
3	EA	SILENCER	SR64		GRY	IVE














Hardware Group No. 23

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		689	IVE
2	EA	OH STOP & HOLDER	90H		689	GLY
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 24













Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 SRT		689	LCN
1	EA	BLADE STOP SPACER	4110-61 SRT		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLT ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.






Hardware Group No. 25

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		689	IVE
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
			MOUNT ON LHR DOOR LEAF.			
1	EA	SURFACE CLOSER	4111 SHCUSH		689	LCN
			MOUNT ON RHR DOOR LEAF.			
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP/HOLDER	WS45X		626	IVE
			FOR USE WITH LHR DOOR LEAF.			
2	EA	SILENCER	SR64		GRY	IVE













Hardware Group No. 26

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH		689	LCN
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 27












Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-M996-06-FS-CON		⚡ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		⚡ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		⚡ BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC Coordinate Power Supply Requirement with Security Provider		⚡ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER ON PULL SIDE MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE, ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, OR ACTIVATION OF FIRE ALARM SYSTEM, DOOR TO REMAIN CLOSED AND LATCHED (FAIL SAFE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 27A










Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-M996-06-FS-CON		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC Coordinate Power Supply Requirement with Security Provider		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER ON PULL SIDE MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE, ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, OR ACTIVATION OF FIRE ALARM SYSTEM, DOOR TO REMAIN CLOSED AND LATCHED (FAIL SAFE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 28







Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO RX CON 12V/24V DC		✂ 626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, DOOR TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.








Hardware Group No. 28A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE












Hardware Group No. 29

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 30

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURF. AUTO OPERATOR	9542IQ NO TRACK COV RSA		✂ ANCL R	LCN
2	EA	ACTUATOR, TOUCH	8310-853T		✂	LCN
2	EA	MOUNT BOX	8310-867F			LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE
1	EA	AI PHONE	MODEL JP-DVF.		✂	

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLTS AND MOMENTARILY ENABLES VESTIBULE ACTUATOR.
3. FROM EGRESS SIDE, CORRIDOR ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
4. AI PHONE IS AVAILABLE FOR AFTER HOURS COMMUNICATION.
5. AUTOMATIC OPERATOR ALLOWS FOR DOOR TO OPEN UPON ACTIVATION OF ACTUATORS.
6. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 30A


















Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURF. AUTO OPERATOR	9542IQ NO TRACK COV RSA		✂ ANCL R	LCN
1	EA	ACTUATOR, TOUCH	8310-818T MOUNT ON PUSH SIDE OF DOOR IN STOREFRONT MULLION.		✂	LCN
1	EA	MOUNT BOX	8310-819F MOUNT ON PUSH SIDE OF DOOR IN STOREFRONT MULLION.			LCN
1	EA	ACTUATOR, TOUCH	8310-853T		✂	LCN
1	EA	MOUNT BOX	8310-867F			LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE
1	EA	AI PHONE	MODEL JP-DVF		✂	

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLTS AND MOMENTARILY ENABLES VESTIBULE ACTUATOR.
3. FROM EGRESS SIDE, CORRIDOR ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
4. AUTOMATIC OPERATOR ALLOWS FOR DOOR TO OPEN UPON ACTIVATION OF ACTUATORS.
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 31

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURF. AUTO OPERATOR	9542IQ NO TRACK COV RSA		✂ ANCL R	LCN
1	EA	WEATHER RING	8310-801			LCN
2	EA	ACTUATOR, TOUCH	8310-853T		✂	LCN
2	EA	MOUNT BOX	8310-867F			LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	1675A		A	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE















1. DURING NORMAL BUSINESS HOURS:
2. DOOR CAN BE UNLOCKED BY ACCESS CONTROL SYSTEM AND OUTSIDE ACTUATOR IS ACTIVE.
3. ENTRY BY PULL OR OUTSIDE ACTUATOR.

1. DURING NON-BUSINESS HOURS:
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLT AND MOMENTARILY ENABLES EXTERIOR ACTUATOR. KEY OVERRIDE AVAILABLE.

1. AT ALL TIMES.
2. FROM EGRESS SIDE, VESTIBULE ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
3. AUTOMATIC OPERATOR ALLOWS FOR DOOR TO OPEN UPON ACTIVATION OF ACTUATORS.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 32






















Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 SRT		689	LCN
1	EA	BLADE STOP SPACER	4110-61 SRT		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	1675A		A	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLT ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 34

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO-CON 24 VDC		⚡ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP-LC-CON 24 VDC		⚡ 626	VON
1	EA	CYLINDER CONTROL	374T-T		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH MOUNT ON LHR DOOR LEAF.		689	LCN
1	EA	SURF. AUTO OPERATOR	9542IQ NO TRACK COV RSA MOUNT ON RHR DOOR LEAF.		⚡ ANCL R	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 SRT AS REQUIRED.		689	LCN
1	EA	BLADE STOP SPACER	4110-61 SRT AS REQUIRED.		689	LCN
1	EA	WEATHER RING	8310-801			LCN
1	EA	RELAY	8310-845		⚡	LCN
1	EA	ACTUATOR, TOUCH	8310-853T		⚡	LCN
1	EA	MOUNT BOX	8310-867F			LCN
1	EA	BOLLARD POST	CTS 6066		⚡ 630	
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	1675A		A	ZER
2	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
2	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		⚡ BLK	SCE
2	EA	DOOR CONTACT	679-05HM		⚡ BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL-FA KL900 120/240 VAC		⚡ LGR	SCE
1	EA	AI PHONE	MODEL JP-DVF.		⚡	












1. DURING NORMAL BUSINESS HOURS:
2. BOTH DOORS CAN BE UNLOCKED BY ACCESS CONTROL SYSTEM AND OUTSIDE ACTUATOR IS ACTIVE.

1. DURING NON-BUSINESS HOURS:
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLTS AND MOMENTARILY ENABLES EXTERIOR ACTUATOR. KEY OVERRIDE AVAILABLE.
3. AI PHONE IS AVAILABLE FOR AFTER HOURS COMMUNICATION.

1. AT ALL TIMES.
2. FROM EGRESS SIDE, VESTIBULE ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
3. ACTIVATION OF ACTUATOR WILL OPEN ONE DOOR LEAF IN SEQUENCE AT C100 & C100.1.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 35











Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
2	EA	DUMMY PUSH BAR	330		626	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH MOUNT ON LHR DOOR LEAF.		689	LCN
1	EA	SURF. AUTO OPERATOR	9542IQ NO TRACK COV RSA MOUNT ON RHR DOOR LEAF.	 ⚡	ANCL R	LCN
1	EA	CUSH SHOE SUPPORT	4110-30 SRT AS REQUIRED.		689	LCN
1	EA	BLADE STOP SPACER	4110-61 SRT AS REQUIRED.		689	LCN
1	EA	ACTUATOR, TOUCH	8310-818T MOUNTED IN LOBBY WAITING AREA.	 ⚡		LCN
1	EA	MOUNT BOX	8310-819F			LCN
1	EA	RELAY	8310-845	 ⚡		LCN
1	EA	VESTIBULE ACTUATOR	8310-855 MOUNTED IN VESTIBULE.	 ⚡		LCN
1	EA	MOUNT BOX	8310-867F			LCN
1	EA	BOLLARD POST	CTS 6066	 ⚡	630	

1. DOORS NORMALLY CLOSED.
2. ENTRY BY PULLS OR ACTIVATION OF VESTIBULE ACTUATOR.
3. FROM EGRESS SIDE, LOBBY WAITING ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
4. ACTIVATION OF ACTUATORS WILL OPEN ONE DOOR LEAF IN SEQUENCE AT C100.1 & C100.
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.













Hardware Group No. 36

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		689	IVE
1	EA	SURFACE CLOSER	4111 HEDA MOUNT ON LHR DOOR LEAF.		689	LCN
1	EA	SURFACE CLOSER	4111 SHCUSH MOUNT ON RHR DOOR LEAF.		689	LCN
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 37





















Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-M996-06-FS-CON		⚡ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		⚡ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		⚡ BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC Coordinate Power Supply Requirement with Security Provider		⚡ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER ON PULL SIDE MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE, ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. UPON LOSS OF POWER, OR ACTIVATION OF FIRE ALARM SYSTEM, DOOR TO REMAIN CLOSED AND LATCHED (FAIL SAFE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 38

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO-CON 24 VDC		✂ 626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP-LC-CON 24 VDC		✂ 626	VON
1	EA	CYLINDER CONTROL	374T-T		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
1	EA	SURF. AUTO OPERATOR	9553IQ LONG2 LESS TRACK COV2 RSA		✂ ANCL R	LCN
1	EA	WEATHER RING	8310-801			LCN
1	EA	RELAY	8310-845		✂	LCN
1	EA	ACTUATOR, TOUCH	8310-853T		✂	LCN
1	EA	MOUNT BOX	8310-867F			LCN
1	EA	BOLLARD POST	CTS 6066		✂ 630	
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING/SEALS	PROVIDED BY STOREFRONT DOOR & FRAME MANUFACTURER			
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	1675A		A	ZER
2	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
2	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
2	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL-FA KL900 120/240 VAC		✂ LGR	SCE










1. DURING NORMAL BUSINESS HOURS:
2. BOTH DOORS CAN BE UNLOCKED BY ACCESS CONTROL SYSTEM AND OUTSIDE ACTUATOR IS ACTIVE.

1. DURING NON-BUSINESS HOURS:
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLTS AND MOMENTARILY ENABLES EXTERIOR ACTUATOR. KEY OVERRIDE AVAILABLE.

1. AT ALL TIMES.
2. FROM EGRESS SIDE, VESTIBULE ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
3. ACTIVATION OF ACTUATOR WILL OPEN DOORS IN SEQUENCE AT C103 & C103.1.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 39







Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		628	IVE
2	EA	DUMMY PUSH BAR	330		626	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
1	EA	SURF. AUTO OPERATOR	9553IQ LONG2 LESS TRACK COV2 RSA		⚡ ANCL R	LCN
1	EA	ACTUATOR, TOUCH	8310-818T MOUNTED IN LOBBY WAITING AREA.		⚡	LCN
1	EA	MOUNT BOX	8310-819F			LCN
1	EA	RELAY	8310-845		⚡	LCN
1	EA	VESTIBULE ACTUATOR	8310-855 MOUNTED IN VESTIBULE.		⚡	LCN
1	EA	MOUNT BOX	8310-867F			LCN

1. DOORS NORMALLY CLOSED.
2. ENTRY BY PULLS OR ACTIVATION OF VESTIBULE ACTUATOR.
3. FROM EGRESS SIDE, TRAINING LOBBY ACTUATOR ENABLED. FREE EGRESS AT ALL TIMES.
4. ACTIVATION OF ACTUATORS WILL OPEN DOORS IN SEQUENCE AT C103.1 & C103.
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.

Hardware Group No. 40



















Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
2	EA	PANIC HARDWARE	LD-9847WDC-L-BE-06-SNB		626	VON
2	EA	SURFACE CLOSER	4111 EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	MAGNETIC WALL HOLDER	SEM7800 SERIES	 ⚡	689	LCN
2	EA	SILENCER	SR64		GRY	IVE

1. DOORS MAY BE HELD OPEN WITH MAGNETIC HOLDERS TIED INTO THE BUILDING'S FIRE ALARM SYSTEM.
2. UPON LOSS OF POWER, OR ACTIVATION OF FIRE ALARM SYSTEM, MAGNETIC HOLDERS TO RELEASE DOORS, ALLOWING THEM TO CLOSE AND LATCH.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. CONDUIT, WIRING AND POWER REQUIRMENTS AND INTERFACE BY DIV 26/28.

Hardware Group No. 41






Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY		628	IVE
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	AUTO FLUSH BOLT	FB41P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	EU MORTISE LOCK	L9095TEU 06A CON 12/24 VDC		⚡ 626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
2	EA	FSIC CORE	23-030		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		689	IVE
2	EA	SURFACE CLOSER	4011		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK		BK	ZER
2	EA	MEETING STILE	8192AA		AA	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
2	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		⚡ BLK	SCE
2	EA	DOOR CONTACT	679-05HM		⚡ BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL-FA KL900 120/240 VAC		⚡ LGR	SCE

1. DOORS NORMALLY CLOSED AND LOCKED FROM BOTH SIDES.
2. ENTRY FROM CORRIDOR TO LOBBY WAITING AREA BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. ENTRY FROM LOBBY WAITING AREA TO CORRIDOR BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER HANDLE ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
4. UPON LOSS OF POWER OR ACTIVATION OF FIRE ALARM SYSTEM, DOORS TO REMAIN CLOSED AND LOCKED (FAIL SECURE).
5. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.








Hardware Group No. 42

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	OH STOP & HOLDER	90H		689	GLY
3	EA	SILENCER	SR64		GRY	IVE







Hardware Group No. 43

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
















Hardware Group No. 44

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 45














Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	CD-98-NL		626	VON
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	MULLION STORAGE KIT	MT54		689	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX		626	SCH
3	EA	FSIC CORE	23-030		626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
2	EA	DOOR CONTACT	679-05HM	 ✎	BLK	SCE

1. DOOR POSITION SWITCHES CAN MONITOR DOORS FOR OPEN/CLOSED POSITION.
















Hardware Group No. 46

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CONST LATCHING BOLT	FB51P		630	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB		689	IVE
1	EA	OH STOP & HOLDER	90H		689	GLY
			MOUNT ON RHR DOOR LEAF.			
2	EA	SURFACE CLOSER	4011		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
			FOR USE WITH LHR DOOR LEAF.			
1	EA	MEETING STILE	383AA		AA	ZER
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 47








Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	224XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-CON 24 VDC		✂ 626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630- 316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	WIRE HARNESS	CON-XXX (LOCK/EXIT TO HINGE FRAME)			VON
1	EA	WIRE HARNESS	CON-XXP (FRAME TO POWER SUPPLY)			VON
1	EA	CARD READER	MTB15 5VDC - 28VDC (SUPPLIED BY SECURITY INTEGRATOR)		✂ BLK	SCE
1	EA	DOOR CONTACT	679-05HM		✂ BLK	SCE
1	EA	POWER SUPPLY	PS902 KL900 120/240 VAC		✂ LGR	SCE

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS EXIT DEVICE LATCH BOLT ALLOWING ENTRY. KEY OVERRIDE AVAILABLE.
3. FROM EGRESS SIDE, FREE EGRESS AT ALL TIMES.
4. CONDUIT, WIRING, POWER, AND ACCESS CONTROL SYSTEM INTERFACE AND REQUIREMENTS BY DIV 26/28.







Hardware Group No. 48

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	THE ULTIMATE RESTROOM PULL	1835-3		630	TRM
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE







Hardware Group No. 49

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK		BK	ZER

Hardware Group No. 50

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	FSIC CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK		BK	ZER

END OF SECTION

SECTION 088000
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass ; 12 inches square.
 - 1. Tinted glass.
 - 2. Coated glass.
 - 3. Laminated glass.
 - 4. Insulating glass.
 - 5. Spandrel glass.
- C. Glazing Accessory Samples: For sealants colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturers of fabricated glass units .
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not

attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

- C. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
1. Design Wind Pressures: As indicated on Drawings .
 - a. Wind Design Data: As indicated on Drawings.
 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick .
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.
- F. Acoustic Performance:
1. Interior Glazing: Provide sound control assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating: 48 STC for assemblies indicated with [AW ##]

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm .
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Glass LLC.
 - b. Pilkington North America; NSG Group.
 - c. Vitro Architectural Glass.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
- E. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction .
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pecora Corporation.
 - b. Sika Corporation.
 - c. The Dow Chemical Company.
 - d. Tremco Incorporated.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type : Annealed Heat-strengthened Fully tempered float glass.

1. Minimum Thickness: 6 mm .
2. Safety glazing required.
3. Provide or decorative film overlay where indicated.

3.9 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type: (GL-2 and GL-3)

1. Basis-of-Design Product: Vitro Solarban 60 (2) SolarGray + Clear .
2. Overall Unit Thickness: 1 inch .
3. Minimum Thickness of Each Glass Lite: 1/4" clear glass .
4. Outdoor Lite: Annealed Heat-strengthened Fully tempered as required by codes and as specified on drawings float glass.
5. Interspace Content: Air.29, Argon .24.
6. Indoor Lite: Annealed as required by codes and as specified on drawings float glass.
7. SHGC: 0.25
8. VLT%: 35%
9. Safety glazing required.

END OF SECTION

SECTION 088300
MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Silvered flat glass mirrors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors in accordance with 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.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 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 manufacture.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- B. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Binswanger Glass Company, Inc.; a division of Vitro Architectural Glass.
 - 2. Gardner Glass, Inc.
 - 3. Guardian Glass LLC.
 - 4. Independent Mirror Industries, Inc.
 - 5. Lenoir Mirror Company.
 - 6. National Glass Industries, Inc.
 - 7. Trulite Glass & Aluminum Solutions, LLC.
 - 8. Virginia Mirror Company, Inc.
- B. Mirrors, General: ASTM C1503.

- C. 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; clear .
 - 1. Nominal Thickness: 6.0 mm .
- D. 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.
- 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. Aluminum J-Channel 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.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - 3) Stylmark, Inc.
 - 2. Aluminum J-Channel 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.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - 3) Stylmark, Inc.
 - 3. 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. Shop fabricate mirrors to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.
- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- 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 and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION

SECTION 088610
SECURITY AND SAFETY GLAZING FILM

PART 1 – GENERAL

A. SUMMARY

1. This Section includes the following:
 - a. Safety glazing film applied to glazing in-place.

B. REFERENCES

1. American Society for Testing and Materials (ASTM) D4830 - Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.
2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
4. ASTM F1642 Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
5. American National Standards Institute (ANSI): ANSI Z97.1(CPSC 1201) Safety Glazing Materials Used In Buildings.
6. H. P. White Laboratory, Inc., Ballistic Resistance Test HPW-TP-0500.02.
7. WBE Engineering, Inc., Test Program for Evaluation of Filmed Windows Subjected to Blast Loads, Test Report 817-001.

C. SUBMITTALS

1. Product Data, including certified third-party test data indicating compliance with specified requirements, and provider's recommended installation procedures.
2. Samples for Selection: Full range of available tinted film colors.
3. Fabricator/applicator qualifications as required by Quality Assurance article.
4. Provider's sample warranty.
5. Maintenance and cleaning instructions.

D. WARRANTY

1. Provide provider's standard limited warranty, covering replacement film materials and film installation labor, against adhesive failure, film discoloration and distortion, peeling or delamination, and on film-protected units that are intentionally broken, for the Life Of The Installation.

PART 2 – PRODUCTS

A. SECURITY AND SAFETY GLAZING FILM

1. Manufacturers:

- a. Basis-of-Design: ShatterGARD, Inc., 8351 Roswell Road Suite 391, Atlanta, GA 30350; Voice: (888) 306-7998; Fax: (888) 646-8913; Website: <http://www.shattergard.com/>.
- b. 3M Window Films, 3M Center, Building 220-12E-04 St. Paul, MN 55144-1000. Website: www.3M.com/windowfilm.
- c. Other manufacturers, pending Architect's approval.

2. Products:

- a. Basis-of-Design: BlastGARD 9: .009 inch (1.19 mm) film: GSA approved fragment retention window protection. Concerns: Minor ballistic, industrial explosion, bomb blasts. Protect occupants from flying glass.

B. MATERIALS

1. Security and Safety Glazing Film: Optically clear, tear-resistant, penetration-resistant, and abrasion-resistant polyester film with pressure-sensitive adhesive, complying with the following:
 - a. 9 mil.
 - b. Puncture resistance per ASTM D4830: 185 lbf (823 N) average.
 - c. Visible Light Transmittance (film only): 85 percent.
 - d. Total Ultraviolet Rejected (film only): 99 percent.
 - e. Total Solar Energy Rejected (film only): 21 percent.

PART 3 – EXECUTION

A. EXAMINATION

1. Examine glazing surfaces to receive security and safety glazing film application. Report conditions detrimental to application of film in writing to Architect. Do not apply film to substrates until approved.

B. PREPARATION

1. Clean glass substrates in accordance with provider's instructions. Test substrate after cleaning for adhesion when recommended.

C. APPLICATION

1. Install security and safety glazing film to interior side of inboard glass lite on glazing units indicated.
2. Apply security and safety glazing film in strict accordance with written architectural specification. Apply film to prepared glass surface, ensuring complete adhesion of film.
3. Film Edge Condition: Apply film with edge condition indicated.
 - a. Apply film to daylight glass opening, from stop to stop. Trim film neatly at perimeter within 1/8 inch of gasket or frame.

D. CLEANING AND PROTECTION

1. Do not disturb or clean film for minimum 30-45 days following application. Delay cleaning film until bubbles of temporarily trapped moisture are no longer visible behind film.
2. Clean film in accordance with provider's instructions. Leave film and adjoining finishes free of fingerprints, adhesive, or other surface blemish resulting from this application.
3. Protect film from damage due to construction operations.

END OF SECTION

SECTION 089000
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
 - 2. Wall vents (brick vents).

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Include supports, anchorages, and accessories required for complete assembly.
- C. Provide subsills made of same material as louvers or extended sills for recessed louvers.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Greenheck Fan Corporation.
 - d. Industrial Louvers, Inc.
 - e. Nystrom Building Products.
 - f. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: 4 inches (100 mm).

3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver (50%).
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Aluminum.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: 1 inch (25 mm).
 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard frames, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 6. Panel Finish: Same finish applied to louvers.

2.6 WALL VENTS (BRICK VENTS)

- A. Extruded-Aluminum Wall Vents:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Greenheck Fan Corporation.
 - d. Industrial Louvers, Inc.
 - e. Nystrom Building Products.
 - f. Ruskin Company; Tomkins PLC.
- 2. Extruded-aluminum louvers and frames, not less than 0.125-inch nominal thickness, assembled by welding; with 18-by-14- mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.
- 3. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 092900
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal stud wall framing; metal channel ceiling framing; gypsum board and joint treatment; gypsum sheathing; and acoustic insulation.

1.2 REFERENCES

- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C645 - Non-Load Bearing (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- D. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
- E. ASTM C840 - Application and Finishing of Gypsum Board.
- F. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
- G. GA-216 (Gypsum Association) - Recommended Specifications for the Application and Finishing of Gypsum Board.
- H. GA-600 (Gypsum Association) - Fire Resistance Design Manual.
- I. UL (Underwriters Laboratories, Inc.) - Fire Resistance Directory.

1.3 PERFORMANCE REQUIREMENTS (Verify fire-rated partitions)

- A. Conform to applicable code for fire rated assemblies as follows:
 - 1. Fire Rated Partitions: Listed assembly by UL Numbers as indicated on partition types.
 - 2. Fire Rated Ceiling and Soffits: Listed assembly by UL as indicated.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate special details associated with fireproofing, and acoustic seals.
- B. Product Data: Submit data on metal framing, gypsum board, joint tape; acoustic accessories and all trim pieces.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, ASTM C1280, GA-214, GA-216 and GA-600.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum five years documented experience. Installer to submit (5) projects completed within the last five years of similar size and scope with references and contact numbers of project managers and project superintendents.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. National Gypsum Co.
 - 2. G-P Gypsum Corp.
 - 3. Celotex Building Products.
 - 4. United States Gypsum Co.
 - 5. No Substitutions.

2.2 COMPONENTS

- A. Studs: ASTM C645; nominal 25-guage; 0.0179" minimum thickness of base metal for interior assemblies except 20-guage 0.0328" minimum thickness for reinforcement at door frames and ceramic wall tile assemblies.
- B. Depth of Section: As indicated on the drawings.
- C. Runners: Match studs; provide type recommended by stud manufacturer for floor and ceiling support of studs. Top track connection to structural steel frame shall be by deep leg tracks, metal angle clips or zee sections as required for spray-on fireproofing of steel members.
- D. Coating: All members shall be galvanized per ASTM A525 and ASTM A591.
- E. Furring, Framing, and Accessories: ASTM C645, GA-216 and GA-600.
- F. Fasteners: ASTM C514, ASTM C1002 and GA-216 as recommended by board manufacturer.
- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- H. Adhesive: ASTM C557, GA-216 and as recommended by board manufacturer

- J. Gypsum Board Materials:
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:
 - i. American Gypsum Co.
 - ii. G-P Gypsum.
 - iii. National Gypsum Company.
 - iv. USG Corporation.
 2. Standard Gypsum Board: ASTM C36; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges
 3. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges. See UL Assemblies for approved products.
 4. Moisture Resistant Gypsum Board: ASTM C630; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges, and damp areas such as bathrooms, toilets (above wainscots).
 5. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - a. Thickness: 1/2 inch.
 - b. Long Edges: Tapered.
 6. Abuse-Resistant Gypsum Board:
 - a. Use at all walls to 8'-0" above finished floor in following rooms:
 - 001 Lower Level Lobby
 - 002 Intake Visitation
 - 006 Intake Visitation
 - T001 Toilet
 - T002 Toilet
 - T003 Toilet
 - 100 Lobby/Waiting
 - 101 Children's Play Area
 - T100 Toilet
 - T101 Toilet
 - 200 Upper Lobby
 - T200 Toilet
 - T201 Toilet
 - b. ASTM C36; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
 - c. Type "X" Fire-rated where noted in UL assemblies
 7. Exterior Gypsum Soffit Board:
 - a. ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

- b. Core: 5/8 inch, Type X.

2.3 ACCESSORIES

- A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- B. Corner Beads: Metal.
- C. Edge Trim: GA-216; Type LC, L, LK, U exposed reveal bead. Shape as required.
- D. Joint Materials: ASTM C475; GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and water.
- E. Fasteners: ASTM C1002, Type S12 and GA-216 as recommended by accessory manufacturer.
- F. Drywall Suspension System: For ceilings provide Direct Suspension as manufactured by U. S. Gypsum Company or approved equal. Install per manufacturer's directions.
- G. Preformed Drywall Trims:
 - 1. Reveals: Gordon Series 400 #412-518 Pittcon Model SWR-0630-063, where indicated on drawings.
- H. Screws: ASTM C1002, with corrosion resistant treatment (at tiled areas)
- I. Corner Guards: 1" x 1" Aluminum corner guards – Cap Industries or approved equal. Install in locations as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturer.

3.2 INSTALLATION

- A. Metal Stud Installation:
 - 1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
 - 2. Metal Stud Spacing: 16 inches on center.
 - 3. Extend stud framing to bottom of roof deck or structure. Attach ceiling runner securely to framing in accordance with details indicated. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
 - 4. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

5. Blocking: Screw wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, etc.
- B. Ceiling Framing Installation:
 1. Install in accordance with ASTM C754.
 2. Coordinate location of hangers with other work.
 3. Install ceiling framing independent of walls, columns, and above ceiling work.
 4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
 5. Laterally brace entire suspension system.
- C. Acoustic Accessories Installation:
 1. Install acoustic sealant within partitions.
- D. Gypsum \Board Installation:
 1. Install gypsum board in accordance with GA-216 and GA-600.
 2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing. Extend board 4 inches above ceiling or to roof deck, whichever is lower.
 3. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
 4. Use screws when fastening gypsum board to metal furring or framing.
 5. Double Layer Applications for Rated Partitions: Place first layer perpendicular to framing members. Use fire rated gypsum backing board for fire rated partitions and ceilings.
 6. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
 7. Treat cut edges and holes in moisture resistant gypsum board with sealant.
 8. Place control joints consistent with lines of building spaces as indicated or as directed.
 9. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
 10. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C840.
 - a. Install sound attenuation blankets (where indicated on drawings) prior to gypsum board unless readily installed after board has been installed.
 - b. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

- c. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
 - d. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
 - e. Do not install imperfect, damaged or damp boards.
 - f. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.
 - g. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide ¼ inch to ½ inch space and trim edge with “L” or “LC” edge trim. Seal joints with acoustical sealant.
11. Install reveal moldings where board abuts dissimilar materials.

E. Joint Treatment:

- 1. Finish in accordance with GA-214 Level (1) above ceilings only, behind ceramic tile or (2 and 3) above ceilings only, (4) storage and utility areas, (5) all public and office areas.
- 2. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- 3. Feather coats on to adjoining surfaces so that camber is per finish level (i.e., 1/32 inch for level (4) and no camber for level (5)).
- 4. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

END OF SECTION

SECTION 093013
CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Tile backing panels.
5. Waterproof membranes.
6. Crack isolation membranes.
7. Setting material.
8. Grout materials.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Tile backing panels.
5. Waterproof membranes.
6. Crack isolation membranes.
7. Setting material.
8. Grout materials.

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.

- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.
3. Metal flooring transitions 6-inch lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, including product use classification.

D. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Trowel of Excellence member of the Tile Contractors' Association of America – provide certificate.
2. Installer to submit five (5) projects completed within the last five years of similar size and scope with references and contact numbers of project managers and tile project superintendent.

B. A pre-installation conference shall be held between Architect, Applicator, General Contractor, and the Owner to review and clarify this specification, application procedure, quality control, inspection, and acceptance criteria, and production schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in "Referenced Standards" Article in the Evaluations and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 PORCELAIN TILE

A. Porcelain Tile Type: [PT-1] Stair treads & risers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crossville, Inc.
 - b. Daltile; a brand of Dal-Tile Corporation. (Basis of Design)
 - c. Florida Tile, Inc.
2. **PT-1:** Porcelain Tile: Provide flat tile complying with the following requirements.
 - a. Style: Daltile, Volume 1.0, Matte Porcelain Tile
 - b. Nominal Size: 12" x 24"
 - c. Color(s): See Finish Legend
 - d. Thickness: 5/16-in
 - e. Finish: Matte
 - f. Edge: Rectified
 - g. Shade Variation: V2
 - h. Grout: As selected by Architect from manufacturer's standard colors
 - i. Design: Stacked
 - j. Location(s): Stair treads & risers
 - k. Accessories: Aluminum slip resistant stair nosing at tile treads, basis of design: Schluter trep-e

2.3 GLAZED WALL TILE

A. Glazed Wall Tile Type: Wall Tile [CT-1] [CT-2] & [CT-3]:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Umore (Basis of Design)
 - b. American Olean; a brand of Dal-Tile Corporation.
 - c. Crossville, Inc.
 - d. Daltile; a brand of Dal-Tile Corporation.
2. **CT-1 & CT-2:** Ceramic Wall Tile
 - a. Style: Umore, Bologna Ceramic Wall Tiles
 - b. Nominal Size: 3" x 12"
 - c. Color(s): See Finish Legend
 - d. Thickness: 0.33-inch
 - e. Finish: Glossy
 - f. Edge: Pressed
 - g. Shade Variation: V1 Uniform Appearance
 - h. Grout: As selected by Architect from manufacturer's standard colors
 - i. Design: See finish elevations.
 - j. Location(s): Typically behind EWCs and other select areas; see finish plans, schedules, and elevations.
 - k. Accessories: Metal transition strips at all tile terminations and outside corners, typ. See tile elevations and details on A701 Finish Schedule.

3. **CT-3: Ceramic Wall Tile**
 - a. Style: Color Wheel Classic Ceramic Wall Tiles
 - b. Nominal Size: 4" x 4"
 - c. Color(s): 0100 White
 - d. Thickness: 5/16-inch
 - e. Finish: Gloss
 - f. Edge: Pressed
 - g. Shade Variation: V1 Uniform Appearance
 - h. Grout: As selected by Architect from manufacturer's standard colors
 - i. Design: Horizontal Stacked; See finish elevations.
 - j. Location(s): Jan Sink wall protection.
 - k. Accessories: Metal transition strips at all tile terminations (Basis of Design Schluter Rondec). See detail on A701.

2.4 TILE BACKING PANELS

- A. Fiberglass-Mat Faced Gypsum Backing Board (TBB – at tiled surfaces): ASTM C1178:

1. Manufacturers: Subject to compliance with requirements.
 - a. Acceptable Products: DensShield Tile Backer, Georgia-Pacific Gypsum, or approved equal.
 - b. Thickness: ½ inch at non fire-rated walls and 5/8 inch Type X at fire-rated walls
 - c. Width: 4 feet
 - d. Length: 8 feet
 - e. Weight: 2.0 lb/sq. ft.
 - f. Edges: Square
 - g. Surfacing: Coated fiberglass mat on face, back, and long edges.
 - h. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
 - i. Microbial Resistance (ASTM D6329, EPA 12-week protocol): Will not support microbial growth.
 - j. Permeance (ASTM E96): Not more than 1.0 perms when tiled.

2.5 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.

2. Locations: For Thin-set Tile Installations (at all locations recommended in the TCNA Handbook including but not limited to large format tiles (typically don't see it required at large format unless in toilets/ showers on raised slabs- is this new?), tile landings and showers)

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Locations: For Thin-set Tile Installations (at all locations recommended in the TCNA Handbook including but not limited to large format tiles, tile landings and showers)

2.7 SETTING MATERIALS

- A. Mortar Materials:
 1. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 2. 1:1: Portland cement-hydrated lime-sand mix, in accordance with manufacturer's instructions.
 3. Mapei Ultraflex LFT: Large Format Porcelain Tile
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
- C. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

2.8 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
 1. Sand-Portland Cement as Dry-Set type

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Metal Edge Strips: L-shaped profile with 1/8" (3.2 mm) wide top and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer. Basis of Design: Schluter SCHIENE (or approved equal).
 - 1. Anchoring Leg:
 - a. Provide with straight anchoring leg
 - b. Provide with special radius anchoring leg for radius applications
 - 2. Material and Finish: Satin Anodized Aluminum
 - 3. Height: To match tile and setting bed thicknesses.
 - 4. Locations: As called out on drawings.
- C. Cove Base Transition: Anodized aluminum profile with single integrated trapezoid-perforated anchoring leg and dovetailed channel, connected at a 90 degree angle by a cove-shaped 3/8" (10 mm) radius section that forms the visible surface. Basis of Design: Schluter DILEX-AHKA (or approved equal).
 - 1. Material and Finish: Satin Anodized Aluminum.
 - 2. Height: To match tile and setting bed thicknesses.
 - 3. Locations: As called out on drawings.
- D. Perimeter Joint Profile: Profile with integrated rigid, recycled PVC trapezoid-perforated anchoring leg and dovetailed channel, which are connected by a 3/16" (5 mm) wide soft CPE movement zone that forms visible surface, and a slit lower movement zone of soft CPE. Basis of Design: Schluter DILEX-BWA (or approved equal).
 - 1. Material and Finish: To be selected by Architect in conjunction with grout color selection.
 - 2. Height: To match tile and setting bed thicknesses.
 - 3. Locations: As called out on drawings.
- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION. GENERAL

- A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.
 - 1. Add materials, water, and additives in accurate proportions.
 - 2. 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.
- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches or larger.
 - 2. 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.
 - 3. 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.
 - 4. Provide manufacturer's standard trim shapes, satin stainless steel or satin anodized aluminum trim pieces as indicated on drawings where necessary to eliminate exposed tile edges.
 - 5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 - 6. 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 use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. 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.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. 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.

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where required. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Metal Wall Trim: Install at locations indicated on Drawings.
- H. Metal Transitions: Install per manufacturer's instructions at locations indicated on Drawings.
- I. Grout Sealer: Apply grout sealer to grout joints in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- D. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

END OF SECTION

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. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
 - 1. Ceiling suspension-system members
 - 2. Structural members to which suspension systems will be attached
 - 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.

6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles
 - d. Speakers.
 - e. Access panels.
 - f. Perimeter moldings
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Product test reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area.
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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Multiple products will be required
- 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 reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A in accordance with ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.4 ACOUSTICAL PANELS [ACP]

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Ceiling & Wall Solutions.
2. Rockfon; ROCKWOOL International.
3. USG Corporation.

- B. Acoustical Panel Standard: Manufacturer's standard panels in accordance with ASTM E1264.

- C. **[ACP-1]** ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – (Offices, Corridors, Conference Rooms, Etc.

1. Basis of Design: Armstrong Mesa Tegular (Item Number 681) 15/16" Angled Tegular.
2. Color: White.
3. Light Reflectance (LR): 0.85.
4. Ceiling Attenuation Class (CAC): 35.
5. Noise Reduction Coefficient (NRC): 0.60.
6. Thickness: 3/4 inch.
7. Modular Size: 24 by 24 inches.

- D. **[ACP-2]** ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – (Toilets, Janitor's Closets)

1. Basis of Design: Armstrong World Industries, Inc.; Calla Health Zone. Item Number 2231. Prelude 15/16" Grid.
2. Classification: Provide panels complying with ASTM E 1264 for type, form and pattern as follows:
 - a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 - b. Pattern: CE (perforated, small holes and lightly textured)
3. Color: White
4. LR: Not less than 0.85.
5. NRC: Not less than 0.80

6. CAC: Not less than 38
7. Edge/Joint Detail: Square Lay-in 15/16"
8. Thickness: 1"
9. Modular Size: 24-inch x 24-inch
10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung", unless otherwise indicated. Comply with seismic design requirements.

2.6 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Armstrong Ceiling & Wall Solutions.
 2. Certainteed; SAINT-GOBAIN.
 3. Rockfon; ROCKWOOL International.
 4. USG Corporation.
- B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M.
- C. Narrow-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, G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.
 1. Structural Classification: Intermediate Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush Flanges formed with an integral center reveal.
 4. Cap Material: Cold-rolled steel or aluminum.
 5. Cap Finish: Painted in color as selected from manufacturer's full range.
 6. Location: Typical unless noted otherwise.

2.7 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Post installed bonded anchors
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316.
 2. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.
 3. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint
 4. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts

2.8 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Ceiling & Wall Solutions.
 2. Certainteed; SAINT-GOBAIN.
 3. Fry Reglet Corporation.
 4. Gordon Inc.
 5. Rockfon; ROCKWOOL International.
 6. USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

- C. 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.
 - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker
 - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.9 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. Hilti CP605
 - c. Pecora Corporation; AIS-919.
 - d. Tremco, Inc.; Tremco Acoustical Sealant.
 - 3. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - a. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 - b. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

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 unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.
- B. 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. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 - 3. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 4. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 - 5. Install [**hold-down**] and clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.
- C. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. 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
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards
- D. 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 precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges
 3. 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.
 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 5. Protect lighting fixtures and air ducts according to requirements indicated for fire resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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. Thermoset-rubber base.
 - 2. Thermoplastic-rubber base.
 - 3. Rubber stair accessories.
 - 4. Rubber molding accessories.
 - 5. Landing tile

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- E. Product Schedule: For resilient base and accessory products.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. 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. 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 II, not less than 0.22 W/sq. cm.

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 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 RESILIENT BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexco Corporation.
 - 2. Johnsonite; a Tarkett company.
 - 3. Roppe Corporation; Roppe Holding Company.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous) or Type TP (rubber, thermoplastic).
 - 1. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Thickness: 0.125 inch.

- D. Height:
 - 1. WB-1: 4 Inches
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As selected by Architect from full range of industry colors.

2.2 STAIR ACCESSORIES

- 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexco Corporation.
 - 2. Johnsonite; a Tarkett company.
 - 3. Nora by Interface.
 - 4. Roppe Corporation; Roppe Holding Company.
- C. Stair Treads and Risers: ASTM F 2169.
 - 1. Type: TS (rubber, vulcanized thermoset)
 - 2. Class: 2 (pattern; embossed, grooved, or ribbed to be selected by Architect).
 - 3. Group: Embedded abrasive strips with contrasting color 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 or, for treads exceeding maximum lengths manufactured, in equal-length units.
- D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
- E. Locations: Provide rubber stair accessories in areas indicated.
 - 1. S002 Stairs – Rubber Stair Treads, Risers & Intermediate & Top and Bottom Landings
 - 2. S102 Stairs - Rubber Stair Treads, Risers & Intermediate & Top and Bottom Landings
 - 3. S202 Stairs – Rubber Stair Treads, Risers & Intermediate & Top and Bottom Landings
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RESILIENT MOLDING ACCESSORY (TRANSITIONS, NOSINGS, AND RISERS)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Roppe Corporation; Roppe Holding Company.
 - 2. VPI Corporation.
- B. Description: Rubber carpet edge and risers for glue-down applications nosing for carpet reducer strip for resilient floor covering transition strips.
- C. Profile and Dimensions: As required between dissimilar floor surfaces and materials. Use between dissimilar materials and at band and choir risers- full height of riser with rubber nosing.
- D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 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.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM 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. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- 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 materials are the same temperature as 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. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope 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 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. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply three coat(s).

- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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. Solid vinyl floor tile. (High Performance Luxury Vinyl Tile)
 - 2. Static-control, vinyl composition floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
 - 3. Show grounding locations of grounding strips and connections
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Samples for Initial Selection: For each type of floor tile indicated.
- E. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- F. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors 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 100 sq. ft. for each type, color, and pattern in locations indicated.
 - 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.

1.8 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.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- 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

2.2 SOLID VINYL FLOOR TILE (HIGH PERFORMANCE LUXURY VINYL TILE) [LVT-1] & [LVT-2]

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Armstrong Flooring, Inc.
- 2. Shaw Contract (Basis of Design)
- 3. Patcraft; a division of Shaw Industries, Inc.
- 4. Shaw Industries Group, Inc.; Berkshire Hathaway Company.

- B. Basis of Design:

- 1. **[LVT-1]** : Shaw Contract Terrain II, 0454V (Basis of Design)
 - a. Overall Thickness: 0.098-in (2.5mm)
 - b. Wear Layer Thickness: 20mil (0.51mm)
 - c. Plank/ Tile Sizes: 6-in x 48-in
 - d. Color: Satinwood 00140
 - e. Installation Method: Brick
- 2. **[LVT-2]** : Shaw Contract Terrace 4108V (Basis of Design)
 - a. Overall Thickness: 0.098-in (2.5mm)
 - b. Wear Layer Thickness: 20mil (0.51mm)
 - c. Plank/ Tile Sizes: 12-in x 24-in
 - d. Color: Lotus 08111
 - e. Installation Method: Brick

- C. Tile Standard: ASTM F 1700.

- 1. Class: As indicated by product designations.
- 2. Type: A, Smooth Surface.

2.3 STATIC-CONTROL, VINYL COMPOSITION FLOOR TILE **[SDT-1]**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Armstrong World Industries, Inc.
- 2. Roppe.

3. VPI Corporation, ESD Tile (Basis of Design)
- B. Source Limitations: Obtain floor tile from single source from single manufacturer.
- C. Static-Control Properties: As determined by testing identical products in accordance with test method indicated by an independent testing and inspecting agency.
 1. Electrical Resistance:
 - a. Material: Point-to-point and point-to-ground resistances between 1,000,000 ohms and 1,000,000,000 ohms when tested in accordance with ASTM F150 ESD STM7.1 .
 - b. Material in Combination with a Person: Average resistance of 448,000,000 ohms when tested in accordance with ESD STM97.1.
 2. Static Generation: When tested in accordance with ESD STM97.2, an average of less than 30 V when tested at 12 percent relative humidity with static-control footwear.
 3. Static Decay: 1000 to 100 V in maximum of 0.2 seconds at 12 percent relative humidity when tested in accordance with manufacturer's standard test protocol using an operator wearing static-control footwear and a static decay meter .
- D. Critical Radiant Flux: 0.45 W/sq. cm or greater in accordance with ASTM E648 or NFPA 253.
- E. Construction: ASTM F1066 Class 2, vinyl composition floor tile, through pattern.
- F. Thickness: 1/8 inch .
- G. Size: 12 by 12 inches.
- H. Colors and Patterns: Platinum 17

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives:
 1. Standard: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 2. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.
- C. Grounding Strips: Provided or approved by manufacturer. Type and size that maintains electrical continuity of flooring-covering system to ground connection.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- 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 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM 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. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- 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 materials are the same temperature as 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 INSTALLATION, GENERAL

- A. Install static-control resilient flooring in accordance with manufacturer's written instructions.
- B. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.
 - 1. For adhesively installed flooring, embed grounding strips in static-control adhesive.
- C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
 - 1. Extend static-control resilient flooring below built-in items and permanent, but movable, items that allow for a flexible layout.
- D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings.
- E. Extend static-control resilient flooring to center of door openings where flooring or color transitions occur.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhesive Installation: Adhere static-control resilient flooring to substrates using a full spread of static-control 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 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 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 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. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 1. Apply three coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 096723
RESINOUS FLOORING

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. Resinous flooring system as shown on the drawings and in schedules.
 - 2. Integral cove base accessories

1.3 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with decorative quartz aggregate broadcast and Epoxy broadcast and topcoats.
- B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/4 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- C. Cove base to be applied where noted on plans and per manufacturers standard details unless otherwise noted

1.4 SUBMITTALS

- A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
- B. Manufacturer's Safety Data Sheet (SDS) for each product being used.
- C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.
- D. Qualification Data: For Installer
- E. Maintenance Data for resinous flooring to be included in maintenance manuals at closeout

1.5 QUALITY ASSURANCE

- A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.
- C. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.
- D. No requests for substitutions shall be considered that would change the generic type of the specified System.
- E. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.
- E. System shall be in compliance with the Indoor Air Quality requirements of California section

01350 as verified by a qualified independent testing laboratory.

- F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarify this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping
 - 1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.
- B. Storage and Protection
 - 1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
 - 2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the Engineer or other personnel.
- C. Waste Disposal
 - 1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

- A. Site Requirements
 - 1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
 - 2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
 - 3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
 - 4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.
- B. Conditions of new concrete to be coated with cementitious urethane material.
 - 1. Concrete shall be moisture cured for a minimum of 3 days and have fully cured a minimum of 5 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
 - 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
 - 3. Sealers and curing agents should not to be used.
 - 4. Concrete shall have minimum design strength of 3,500 psi. and a maximum water/cement ratio of 0.45
 - 5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.
- C. Safety Requirements
 - 1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
 - 2. "No Smoking" signs shall be posted at the entrances to the work area.
 - 3. The Owner shall be responsible for the removal of foodstuffs from the work area.
 - 4. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

- A. Manufacturer warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to manufacturer's published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.

PART 2 – PRODUCTS

2.1 RESINOUS FLOORING [RES-1]

- A. Resinous Flooring System: Abrasion-, impact-, and chemical resistant, aggregate filled, resin-based monolithic floor surfacing designed to product a seamless floor and integral cove base.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams High Performance Flooring: Hybri-Flex EQ or comparable product by one of the following:
 - a. Dur-A-Flex; a Sherwin Williams Company
 - b. Laticrete International, Inc.
 - c. Sherwin-Williams High Performance Flooring. 866-540-1299 swflooring@sherwin.com
 - d. Stonhard, Inc.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
- C. System Characteristics:
1. Color and Pattern: As selected by Architect from manufacturer's full range
 2. Wearing Surface: Textured for slip resistance
 3. Overall System Thickness: 1/4-inch
- D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

SHERWIN-WILLIAMS 4-PART HYBRI-FLEX EQ SYSTEM CONSISTING OF THE FOLLOWING COMPONENTS:

1.	Topping	Poly-Crete SL (Basis of Design)
	Percent Reactive	100%
	VOC	0 g/L
	Bond Strength to Concrete, ASTM D 4541	400 psi, substrates fails
	Compressive Strength, ASTM C 579	9,000 psi
	Tensile Strength, ASTM D 638	2,175 psi
	Flexural Strength, ASTM D 790	5,076 psi
	Impact Resistance @ 125mils, MIL D-3134, No visible damage or deterioration	160 inch lbs
2.	Broadcast Coat	Resuflor Glaze (Basis of Design)
	Percent Reactive	100%
	VOC	<4 g/L
	Water Absorption, ASTM D 570	0.04%
	Tensile Strength, ASTM D 638	4,000 psi
	Coefficient of thermal expansion ASTM D 696	2 x 10 ⁻⁵ in/in/F
	Flammability ASTM D-635	Self-Extinguishing
	Flame Spread/ NFPA 101 ASTM E-84	Class A
3.	Grout Coat	Resuflor Glaze Clear (Basis of Design)
	Percent Reactive	100%
	VOC	<4 g/L
	Water Absorption, ASTM D 570	0.04%
	Tensile Strength, ASTM D 638	4,000 psi

Coefficient of thermal expansion ASTM D 696	2 x 10 ⁻⁵ in/in/F
Flammability ASTM D-635	Self-Extinguishing
Flame Spread/ NFPA 101 ASTM E-84	Class A

4. Topcoat	Resutile AT (Basis of Design)	
VOC	0 g/L	
60 Degree Gloss ASTM D523	75+/-5	
Mixed Viscosity, (Brookfield 25°C)	500 cps	
Tensile Strength, ASTM D 638	7,000 psi	
Abrasion Resistance, ASTM D4060	Gloss	Satin
CS 17 wheel (1,000 g load) 1,000 cycles	4	8 mg loss with grit
	10	12 mg loss without grit
Pot life @ 70° F 50% RH	2 Hours	
Full Chemical resistance	7 days	

- E. Patch and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.
1. Basis of Design Products:
 - a. Shallow Fill and Patching: Sherwin-Williams Poly-Crete MD (up to ¼ inch).
 - b. Deep Fill and Sloping Material (over ¼ inch): Sherwin-Williams Poly-Crete WR or Cemlack UM.

2.2 INTEGRAL COVE BASE ACCESSORIES

- A. Precast, integral Cove Base: Impact-resistant, polymer-resin, cove base moldings with a grit profile to promote adhesion of resinous flooring and recommended in writing by resinous flooring manufacturer.
1. Radius Cove: Cove molding with approximately 1-inch radius for adhesive installation at floor-to-wall joint as substrate to receive resinous flooring system to form an integral cove base.
 2. Radius Cove Base: 4-inch or 6-inch high base molding that provides approximately 1-inch radius cove at floor-to-wall joint; for adhesive installation as substrate for resinous flooring system to form an integral cove base.
 - a. Preformed Inside and Outside Corners: Provide manufacturer's standard square inside and ¾- to 1-inch bullnose outside corner.
- B. Installation Adhesive: As recommended in writing by accessory manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
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 resinous flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrates with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

- C. Moisture Testing: Perform tests recommended by manufacturer and as follows. Provide architect with copy of results prior to proceeding with installation.
1. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
 2. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
- D. Mechanical surface preparation
1. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
 2. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
 3. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 4. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.
- E. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
1. The system shall be applied in five distinct steps as listed below:
 - a. Substrate preparation
 - a. Topping/overlay application with quartz aggregate broadcast.
 - b. Resin application with quartz aggregate broadcast.
 - c. Grout coat application
 - d. Topcoat application.
 2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
 3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
 4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
 5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.
- B. Topping
1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
 2. The topping shall be comprised of three components, a resin, hardener and aggregate as supplied by the Manufacturer.
 3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
 4. The topping shall be applied over horizontal surfaces using ½ inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
 5. Immediately upon placing, the topping shall be degassed with a loop roller.

6. Q11 Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs/sf.
7. Allow material to fully cure. Sweep and vacuum to remove all loose aggregate.

C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 50 sf/gal.
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. Q11 Quartz aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs/sf.
4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Grout coat

1. The grout coat shall be squeegee applied with a coverage rate of 50 sf/gal.
2. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish

E. Topcoat

1. The topcoat shall be roller applied with a coverage rate of 500 sf/gal.
2. The finished floor system will have a nominal thickness of 1/4 inch.

F. Waterproofing Membrane: Apply waterproofing membrane in thickness recommended in writing by manufacturer.

- a. Apply waterproofing membrane to integral cove base substrates.

G. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.

H. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details. Including those for taping, mixing, priming, troweling, sanding, and top coating of cove base. Round internal and external corners.

- a. Integral Cove Base: 4 inches high

I. Troweled or Screeded Body Coats: Apply troweled or screed body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
 - a. Temperature
 1. Air, substrate temperatures and, if applicable, dew point.
 - b. Coverage Rates
 1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.5 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION

SECTION 096813
TILE CARPETING

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.

1.3 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 manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing 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 for Initial Selection: For each type of carpet tile.
 - 1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 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.

1.5 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.

1.6 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 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's 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 levels planned for building occupants 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.

1.10 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, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: Lifetime Limited Carpet Tile Warranty, Lifetime Limited Duracolor Stain Warranty, Lifetime Static.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Interface, Inc.
 - 2. Mohawk Carpet, LLC; The Mohawk Group.
 - 3. Matter Surfaces (Basis of Design)
 - 4. Shaw Industries Group, Inc.; Berkshire Hathaway Company.
 - 5. Tarkett USA.
- B. Available Products – Walk-off Carpet **[CPT-WM]**
 - 1. Manufacturer: Matter Surfaces
 - 2. Collection: Arrival Collection
 - 3. Style: Super Nop 52
 - 4. Color: Charcoal
 - 5. Material Composition: 111% solution-dyed UV-stabilized polypropylene fibers
 - 6. Backing: Bitumen
 - 7. Tile Size: 19.7" x 19.7"
 - 8. Pile Weight: 52 oz/sq yd

9. Total Weight: 141 oz/sq yd
10. Layout: Monolithic

C. Available Products – Carpet Tile **[CPT-1]** Basis of Design

1. Manufacturer: Interface, Inc.
2. Collection: Open Air Neutrals
3. Style: Open Air 418
4. Color: Mist 107795
5. Backing: GlasBac
6. Product Construction: Tufted Textured Loop
7. Yarn System: 100% Recycled Content Nylon
8. Tile Size: 19.69-in x 19.69-in
9. Pile Height: 0.15-in
10. Pile Thickness: 0.08-in
11. Layout: Monolithic

D. Available Products – Carpet Tile **[CPT-2]**

1. Manufacturer: Interface, Inc.
2. Collection: Open Air Stria
3. Style: Open Air 418 Stria
4. Color: Mist 103289
5. Backing: GlasBac
6. Product Construction: Tufted Textured Loop
7. Yarn System: 100% Recycled Content Nylon
8. Tile Size: 19.69-in x 19.69-in
9. Pile Height: 0.14-in
10. Pile Thickness: 0.082-in
11. Layout: Monolithic

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer. (Gypsum-based products are not acceptable.)
- 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.
- C. Metal Edge/Transition Strips: Extruded aluminum with brushed stainless steel finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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 Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- 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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing 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 the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive 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 the Carpet and Rug Institute's CRI 104, Section 13.7.
- 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

SECTION 098410
ACOUSTICAL WALL TREATMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Custom fabricated acoustical wall panels.

1.2 REFERENCES

- A. ASTM International:
1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:
1. Surface Burning Characteristics (ASTM E84-17a, Class A):
 - a. Flamespread: 25, maximum.
 - b. Smoke Developed: 450, maximum.
 - c. Class A Fire Rated
 2. Indoor Air Quality: Low VOCs emissions, formaldehyde and Phenol-free
 3. Light Fastness: ISO 105-B02 1994, 6-7

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, edge profiles and panel components, including anchorage, accessories, finish colors and textures.
- D. Samples: Submit selection and verification samples of finishes, colors and textures.
- E. Test Reports: Certified test reports showing compliance with specified performance requirements.
1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements and Approvals

1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements Section.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install panels until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees F (16 - 27 degrees C) and 45%, respectively.

PART 2 PRODUCTS

2.1 ACOUSTICAL WALL PANELS **[AWP-1], [AWP-2], & [AWP-3]**

- A. Manufacturers:
 - 1. Wolf Gordon
 - 2. CSI Creative
 - 3. Acoufelt (Basis of Design)
 - 4. Huddledesign

2.2 MANUFACTURED UNITS

- A. Acoustical Felt Wall Panels (Basis of Design: Acoufelt Premier Collection Solid Wall Panels)
 - 1. Content: FilaSorb Polyester Felt
 - 2. Thickness: 12mm, 24mm, & 50mm
 - 3. Dimensions: As shown on interior elevation
 - 4. NRC Rating:
 - a. 12mm: 0.45
 - b. 24mm: 0.60
 - c. 50mm: 0.75
 - 5. Fire Test:
 - a. ASTM E84, Class A
 - b. Flame Spread Index: 15
 - c. Smoke Developed Index: 200
 - 6. Colorfastness: ISO 105-B02, 6-7
 - 7. Environmental:
 - a. Recycled Content: Minimum 60%
 - b. Indoor Air Quality: VOC less than/ equal to 0.5mg/m3
 - 8. Colors: As indicated on Room Finish Legend.

2.3 INSTALLATION

- A. General: Install per manufacturer's written instructions.
- B. Allow acoustic panels to acclimate for a minimum of 24 hours prior to installation.
- C. Do not install panels until building HVAC is fully operational.
- D. Ensure that wall substrate is clean and free of dust, holes, or damage prior to panel installation.
- E. Utilize z-clips as recommended by the manufacturer.

END OF SECTION

SECTION 099000
PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
- B. Work includes, but is not limited to:
 - 1. Painting and finishing of interior and exterior exposed items and surfaces including surface preparation and priming. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
 - 2. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
 - 3. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.
 - 4. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 5. Painting includes field painting exposed-to-view bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment except as specified in Divisions 21-25 and/or 26.

1.2 REFERENCES

- A. ASTM D16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D823-95 Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products.
- C. ASTM D5150-92 (1997) e1 Standard Test Method for Hiding Power of Architectural Paints Applied by Roller.
- D. ASTM D3276-96 Standard Guide for Painting Inspectors- (metal substrates).

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

- A. Product Data: Submit data on all finishing products. Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Samples: Provide a listing of material and application for each coat of each finish sample. Submit samples for Architect's review of color and texture only. Submit two paper chip samples, illustrating range of colors and textures available for each surface finishing product scheduled.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum five years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain, fog, mist, or snow when relative humidity is outside the humidity ranges, or moisture content of surfaces exceed those required by the paint product manufacturer.
- C. Minimum Application Temperature for Varnish: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- D. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 degrees F.
- E. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- F. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Provide materials as manufactured by Sherwin-Williams, PPG, Duron, Tnemec, or Benjamin Moore.
- B. The quality of paint shall be equal to Sherwin Williams or Tnemec product numbers as specified in the schedule below.

2.2 SCHEDULE

- A. Exterior Ferrous Metal:
 - 1. First Coat: SW-KEM Kromik Universal Metal Primer, B5ONZ6
 - 2. Second Coat: SW-Silicone Alkyd enamel, B-56 Series
 - 3. Third Coat: SW-Silicone Alkyd enamel, B-56 Series
- B. Exterior Galvanized Metal:
 - 1. First Coat: Tnemec Series 27 F.C. Typoxy Polyamide Epoxy at 3-5 mils. (Coordinate with metal fabrication items required to receive first coat applied in shop.)
 - 2. Second Coat: Tnemec Series 75 Endura – Shield Aliphatic Acrylic Urethane – Satin, 3-4 mils.
 - 3. Field touch up of welds to be primed w/Tnemec Series 90-97 Tnemec-Zinc 2.5-3.5 mils thick prior to receiving first and second coat.

- C. Exterior Concrete Walls / Site Retaining Walls:
 - 1. 2 Coats: LOXON Self-Cleaning Acrylic Coating Flat LX13-0050. (Self-Priming)
- D. Drywall (Walls):
 - 1. Prime Coat (New Walls): SW ProMar 200 Zero VOC Latex Primer, B28W2600, at 1.0 mils dry, per coat.
 - 2. Prime Coat (Existing Walls): SW Multipurpose Primer B51W00453
 - 3. Intermediate Coat: ProMar 200 (Zero VOC) Eg-Shel B41-2600.
 - 4. Top Coat: ProMar 200 (Zero VOC) Eg-Shel B41-2400
- E. Interior Plaster and Drywall (Generally Kitchen & Support, Janitor's Closets, Showers, & Toilets):
 - 1. System Type: Sealer/Epoxy
 - 2. First Coat/Prime Coat: Tnemec Series 151-1051 Elasto-Grip FC. DFT 1.0 to 2.0 mils
 - 3. Intermediate Coat: Series 84 Ceramlon ENV. DFT 3.0 to 5.0 mils
 - 4. Top Coat/Finish Coat: Series 84 Ceramlon ENV. DFT. 3.0 to 5.0 mils
- F. Interior Drywall (Ceilings and Soffits):
 - 1. Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600.
 - 2. Intermediate Coat: ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
 - 3. Top Coat: ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
- G. Interior Concrete Masonry, and Concrete:
 - 1. First Coat: Series: 130 Envirofill high performance block filler.
 - 2. Second Coat: SW-DTM Acrylic semi gloss, B66W200 Series
 - 3. Third Coat: SW-DTM Acrylic semi gloss, B66W200 series
- H. Interior Ferrous Metal: (Other than AESS) Gloss Finish (Water Base)
 - 1. 1st Coat: S-W Pro-Cryl® Universal W/B Primer, B66-310 series (2-4 mils dry)
 - 2. 2nd Coat: S-W Water-based Industrial Enamel, B53-300 Series
 - 3. 3rd Coat: S-W Water-based Industrial Enamel, B53-300 Series

- L. Ferrous Metal with Latex Dry Fog Flat Finish: One finish coat over primed exposed steel roof construction. (Note: Coordinate with masking and painting accent color exposed ductwork as indicated.)
1. Prime Coat: (Acrylic or recommended VOC compliant metal primer.) 2.0 mils DFT.

Duron: (As recommended)

ICI 1280 Spray-master Pro Uni-Grip-WB Aqua-acrylic Dryfall Flat

S-W: B66 W1 DTM Acrylic Primer/Finish
 2. Top Coat: All exposed metal structure as scheduled. Acrylic Dry Fog 3.0 mils DFT.

Duron: Dura Clad Interior Latex Dry Fog Flat 95-108 (4/03/00)

ICI 1280 Spray-master Pro Uni-Grip-WB Aqua-acrylic Dryfall Flat

Moore: M53 Sweep-Up Spray Latex Flat (3/30/00)
- M. Hollow Metal Doors and Frames
1. System Type: High Performance Finish- Semi-Gloss
 2. Prime Coat: SW Pro Industrial Pro-Cryl Universal Metal Primer B66-310 Series (Use manufacturer's recommendation at existing doors and Frames.
 3. Intermediate Coat: SW Pro Industrial Acrylic Coating B66-600 (Zero VOC)
 4. Top Coat: SW Pro Industrial Acrylic Coating B66-600 (Zero VOC)
- N. Interior Concrete Floor Sealer
1. System Type: Water-based epoxy floor coating.
 2. Surface Prep: Clean, dry, sound.
 3. Two Coats: SW Armorseal 8100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator. Starting of

painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

- B. Test shop applied primer for compatibility with subsequent cover materials.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below 8%.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials.
- D. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster.
- H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- J. Metal Doors Scheduled for Painting: All hollow metal frames shall receive one field prime coat, front and back, before erection (color to be medium gray); after erection, touch-up all abrasive marks; this prime coat is in addition to factory prime coat and to the two coats of finish painting specified under Paragraph 2.2. Protect from dust while drying.

- K. Apply a bead of sealant where hollow metal door frames abut adjacent wall surfaces.

3.3 APPLICATION

- A. Spray painting will be permitted wherever practical; however, excess thinning will not be permitted and complete surface coverage shall be equal to that of first class brush work. Do not spray paint concrete block unless it is immediately back-rolled.
- B. Do all touch-up and clean-up at the completion of this work to leave all surfaces in a finished condition.
- C. Where exposed, painting contractor shall paint all ducts, piping, conduit and mechanical and electrical equipment without factory finish, including those in mechanical and electrical rooms.
- D. Visible surfaces on interior of ducts behind louvers, diffusers, registers and grilles shall be primed and then painted with one coat of flat black metal enamel.
- E. Belt guards and other protective guards on equipment shall be painted with two coats of safety yellow metal enamel.
- F. Insulated pipes and ducts with paper or canvas jacket shall be painted with one coat of paint equal to Sherwin Williams SW-Preprite 200 Latex Wall Primary, and insulated surfaces with aluminum foil jacket shall be painted with one coat of Zinc Chromate Primer prior to two coats of finish paint. Armaflex type insulation on exposed pipes shall be painted with two coats of latex base paint equal to SW-PROMAR 200 Latex flat wall paint tinted to match background color.
- G. Mechanical equipment surfaces with asphalt or bitumen coating shall be sealed with an approved asphalt sealer and painted with two coats of SW-KemKromik universal/metal primer, B5ONZ6.
- H. The Architect shall have the right to select in addition to scheduled colors, deep, accent colors for one or more walls, bulkheads, columns, or other features in any of the spaces on the project, up to 2500 sq ft of area.
- I. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- J. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- K. Sand wood and metal surfaces lightly between coats to achieve required finish.
- L. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior applying next coat.
- M. Paint front and back sides of access panels, and removable or hinged covers.

- N. Protect work of other trades, whether being coated or not, against damage from coating.

3.4 CLEANING

- A. Collect waste material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - COLORS

- A. Basis of Design color scheme is noted on the Room Finish Legend. Final color scheme will be prepared by the Architect after receipt of approved manufacturer's color samples. See Architectural Finish Schedule and Finish Plans for the number of paint colors used.
- B. Samples of work receiving natural or stained finish shall be submitted for Architect's review and selection.

END OF SECTION

SECTION 102113.19
PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show overhead support or bracing locations.

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

- D. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturer's standard size .

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" for toilet compartments designated as accessible.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASI Accurate Partitions.
 - 2. ASI Global Partitions.
 - 3. General Partitions Mfg. Corp.
 - 4. Scranton Products.
- B. Toilet-Enclosure Style: Overhead braced , privacy type.
- C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).
 - 1. Color: One color in each room as selected by Architect from manufacturer's full range .
- D. Pilaster Shoes: Manufacturer's standard design; stainless steel.
- E. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum .

- G. Urinal Screens
 - 1. Wall mounted with continuous wall brackets.
 - 2. Size: 24" x 42"

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.
 - 1. Hinges:
 - a. Manufacturer's continuous, cam type that swings to a closed or partially open position , allowing emergency access by lifting door.
 - 1) Material, Continuous Hinge: Manufacturer's standard.
 - b. Manufacturer's standard hinge.
 - 2. Latch and Keeper: Manufacturer's 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 toilet enclosures designated as accessible.
 - a. Material: Manufacturer's standard.
 - 3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - a. Material: Manufacturer's standard.
 - 4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.
 - a. Material: Manufacturer's standard.
 - 5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
 - a. Material: Manufacturer's standard.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

- A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION

SECTION 102226
OPERABLE 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. Section Includes:
 - 1. Manually operated, paired acoustical panel partitions.

1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."
- B. STC: Sound Transmission Class.

1.4 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing indicated.

1. Include similar Samples of accessories involving color selection.
- D. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- E. Qualification Data: For qualified Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.
- G. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 2. Seals, hardware, track, carriers, and other operating components.
- H. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fire-Test-Response Characteristics: Provide panels with finishes meeting one of 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of operable panel partition openings 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 operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Operable acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Modernfold 900 with Track No. 17 or comparable product by one of the following:
 - a. Advanced Equipment Corporation.
 - b. Modernfold, Inc.; a DORMA Group Company.
 - c. Panelfold Inc.
- B. Panel Operation: Manually operated, paired panels.
- C. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 - 1. Panel Width: Equal widths.
- E. STC: Not less than 43.

- F. Panel Thickness: Not less than 3 inches (75 mm).
- G. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

2.2 SEALS

- A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
- B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
- C. Horizontal Bottom Seals:
 - 1. Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13mm) to -1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.3 FINISH FACING

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
 - 2. Color/Pattern: As selected by Architect from manufacturer's full range.
- B. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:
 - 1. Steel, Painted: As selected by Architect from manufacturer's full range.

2.4 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Panel Guide: Aluminum; finished with factory-applied, decorative, protective finish.
 - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 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 panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

3.4 CLEANING

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

END OF SECTION

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Custodial accessories.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 TOILET AND BATH ACCESSORIES

- A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.
- B. Baby Changing Station BC-1
 - 1. Bobrick: KB200-01SS; Horizontal wall mounted with stainless steel veneer – 36" Wide
- C. Grab Bar GB1, GB2, GB3:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
 - 4. Outside Diameter: 1-1/4 inches .
 - 5. Configuration and Length: As indicated on Drawings .
- D. Mirror Unit M1, M2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation .
2. Description: Basis of Design - Bradley 780 sereis
3. Frame: Stainless steel angle, 0.05 inch thick .
 - a. Corners: Welded and ground smooth.
4. Size: As indicated on Drawings .
5. Hangers: Manufacturer's standard rigid, tamper and theft resistant .

E. Paper Towel Dispenser PT-2 :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
2. Description: Paper Towel dispenser Bradley 2497.
3. Mounting: Surface mounted.
4. Dispensing: Push-Lever, Roll
5. Material and Finish: Durable high-impact plastic with heavy gauge steel back

F. Soap Dispenser SD1 :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
2. Description: Soap Dispenser : Bradley 6562.
3. Mounting: Surface mounted.
4. Dispenser Capacity: 40 oz. liquid or foam soap
5. Vandal-resistant filler hole cover and sight gauge
6. Secured with lock
7. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

G. Sanitary-Napkin Disposal Unit SN1 :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
2. Description: Napkin Disposal : Bradley 4A10
3. Mounting: Surface mounted.
4. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
5. Receptacle: Removable.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

H. Toilet Tissue Dispenser TP1 :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
2. Description: Double-roll dispenser Bradley 5402 .
3. Mounting: Surface mounted.
4. Capacity: Designed for (two) standard core 6" diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

2.3 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- C. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 104310
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. Plaques.
 - 2. Exterior Dimensional characters.
 - 3. Interior Panel signs.

1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Aluminum.
 - 2. Acrylic sheet.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless other indicated and as follows:
 - 1. Dimension Character: Full-size Sample of dimensional character
 - 2. Exposed Accessories: Full-size Sample of each accessory type.

3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

E. Product Schedule: Use same designations indicated on Drawings.

F. Qualification Data: For Installer and fabricator.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. 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.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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 metal and polymer finishes beyond normal weathering.
- b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

2.2 DIMENSIONAL CHARACTERS

- A. Cutout Characters : Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:
 - 1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
 - a. ACE Sign Systems, Inc.
 - b. APCO Graphics, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Gemini Signage; Gemini, Inc.
 - e. inpro Corporation.
 - f. Metal Arts.
 - g. Southwell Company (The).
 - 2. Character Material: Sheet or plate aluminum .
 - 3. Character Height: As indicated on Drawings .
 - 4. Thickness: Manufacturer's standard for size of character 0.25 inch .
 - 5. Finishes:
 - a. Integral Aluminum Finish: Anodized color as selected by Architect from standard industry colors and color densities. Basis of design = Black Anodized.
 - 6. Mounting: Flush studs .
 - 7. Font: Avant Garde Medium

2.3 EXTERIOR DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 INTERIOR PANEL SIGNS (ADA)

- 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. APCO Graphics, Inc. - Elevate Frameless Modular Sign System (Basis of Design)
 - 2. Acorn Sign Graphics
 - 3. Advance Corporation; Braille-Tac Division.
 - 4. Allen Industries Architectural Signage
 - 5. Allenite Signs; Allen Marking Products, Inc.

6. ASI-Modulex, Inc.
7. Bayuk.
8. Best Sign Systems Inc.
9. Bunting Graphics, Inc.
10. Fossil Industries, Inc.
11. Gemini Incorporated.
12. Grimco, Inc.
13. Innerface Sign Systems, Inc.
14. InPro Corporation
15. Matthews International Corporation; Bronze Division.
16. Mills Manufacturing Company.
17. Mohawk Sign Systems.
18. Nelson-Harkins Industries.
19. Seton Identification Products.
20. Signature Signs, Incorporated.
21. Supersine Company (The)

B. Features:

1. Sign Assembly:
 - a. Sign shall feature a fully recessed chassis to which modular display panels securely engage, creating a frameless look with the appearance that display panels are floating off of the mounting surface.
2. Display Panels / Inserts:
 - a. Primary display panels shall be 1/8" thick painted acrylic plaques or 1/8" thick satin anodized aluminum plaques with direct-print graphics. Optional display panels shall be 3mm(1/8") aluminum composite plaques with the .012" aluminum skin formed precisely around all four edges of the panel to conceal the panel's composite core. Display panels engage with the concealed chassis in a precise manner to ensure a 1/16" reveal between all panels as a standard. An optional No-Reveal solution enables all panels to butt directly against one another with no inter-insert reveals.
3. Full Bleed Graphics:
 - a. System shall offer options for direct-print graphics that bleed around all four edges/returns of the display panels.
4. Tamper Resistance:
 - a. System must offer an option for a concealed locking method to increase level of tamper resistance.
5. Mounting:
 - a. Signs must be able to accommodate installation via fully concealed mechanical fasteners.
6. Modularity:
 - a. All display panels shall be securely engaged within a concealed chassis but must be easily updatable to accommodate change. Display panels must be removable without the use of a special, proprietary tool.
7. User Letter Paper Inserts:
 - a. System must offer solutions for user updatable paper inserts, including a range of perforated, coated paper and free software with templates for easy creation of graphics.

C. Graphics and Typography:

1. As selected by Architect from manufacturer's standards.

D. Colors and Finishes:

1. As selected by Architect from manufacturer's standards.

E. ADA Compliance:

1. Sign system shall comply with all applicable provisions of the 2010 Standards for Accessible Design (the updated ADA Accessibility Guidelines, ADAAG), effective in March 2011. This includes requirements regarding which sign types require Braille/tactile features, character heights, raised character spacing, raised character stroke width, color contrast and installation locations and mounting heights within the facility.

F. Materials and Construction:

1. Sign shall feature a fully recessed black anodized aluminum chassis to which modular display panels securely engage. Chassis shall be no more than 3/8" in depth and shall be recessed sufficiently behind the panels to give the appearance the panels/inserts are floating off of the mounting surface.
2. Primary display panels shall be 1/8" thick painted acrylic or 1/8" satin anodized aluminum with direct-print graphics. Optional display panels for full-bleed graphics shall be 3mm (1/8") thick aluminum composite (ACM) with the .012" aluminum face formed precisely around all four edges of the panel to conceal its composite core. Display panels must securely engage with the recessed chassis via a concealed attachment method but should be 100% modular to accommodate changes.
3. System shall offer a range of aluminum bands to house user-updatable, perforated paper inserts. Inserts shall be retained on the left and right sides of the aluminum band by .020" clear, flexible end caps.
4. Standard ADA inserts/plaques are acrylic or aluminum with APCO's DP-Tactile process direct-print, UV-cured 1/32" thick tactile characters and fully domed Braille.
5. Standard graphics are UV-cured, direct-print with true 600dpi resolution and the option to bleed around all four edges/returns of the ACM display panels.
6. Attachment: Signs shall be able to accommodate fully concealed mechanical fasteners.

G. Standard Assembly Mounting Options:

1. Vinyl Tape (VT). (Optional for small size signs up to 80sq/in and some larger signs assuming favorable wall surface and environmental conditions.)
2. Vinyl Tape and Silicon Adhesive (SA)
3. Concealed Mechanical Fasteners (MF)

2.5 EXTERIOR POST AND PANEL SIGNS

A. Metal Exterior Post and Panel Signs

1. Metal Exterior Post and Panel Sign: Provide all aluminum post and "convex" panel sign assembly indicated, fabricated of extruded post and frame sections and heavy gauge aluminum sheet equal to Charleston Industries 325 Series sign. Provide radiused post (flush panel face over framing), ground-mount design.
 - a. Post size: 3 1/4" Extended Radius for design standard.

- b. Finish: Baked enamel. White characters on color field to be selected.
 - c. Graphics/Lettering: As indicated. Provide urethane paint for copy over coated with clear transparent urethane matte coating or vinyl die-cut as option.
2. Manufacturers of Metal Exterior Post and Panel Signs:
- a. Acorn Sign Graphics
 - b. ASI Sign Systems, Inc.
 - c. Best Manufacturing Co.
 - d. Charleston Industries, Inc.

2.6 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, 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 stainless steel devices unless otherwise indicated.
 - 3. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors.
 - 4. Furnish inserts, as required, to be set into concrete or masonry work.
 - 5. Provide matching backing panels at locations where are to be installed on glass.

2.7 FABRICATION; DIMENSIONAL LETTER SIGNAGE

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
- B. 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.
- C. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
- D. 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.
- E. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
- F. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
- G. Provide rabbets, lugs, and tabs 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.

- H. 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.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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.
- D. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- E. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- D. Directional Satin Finish: No. 4.
- E. Dull Satin Finish: No. 6.

- F. Reflective, Directional Polish: No. 7.
- G. Mirrorlike Reflective, Nondirectional Polish: No. 8.

2.11 LACQUER COATING FOR COPPER-ALLOY FINISHES

- A. Lacquer Coating: Clear, organic, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of acrylic resin, methyl methacrylate copolymer, leveling agent, and corrosion inhibitor benzotriazole.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- C. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
 - 1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
 - 2. Existing Plaque: The existing plaque is to be reinstalled at a location approved by the Architect.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

- A. General: Install signs using mounting methods indicated 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. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of 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.
 6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.3 CLEANING AND PROTECTION

- 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 surface 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

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.

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 for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, 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 B 209
 - 2. Extruded Shapes: ASTM B 221
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Acrylic Bubble: One piece.

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 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. Fire End & Croker Corporation.
 - b. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 - d. Larsen's Manufacturing Company.
 - e. Potter Roemer LLC; Series 1772 (*Basis of Design*).
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
- E. Cabinet Trim Material: Aluminum sheet.
- F. Door Material: Aluminum sheet.
- G. Door Style: Vertical Duo.

- H. Door Glazing: Clear Acrylic.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
- K. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Interior of cabinet.
 - 2. Aluminum: Clear anodic.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 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. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm 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.

2.7 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 walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated.
 - 1. Fire Protection Cabinets: 48 inches (1219 mm) above finished floor to top of cabinet.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- 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 FMG.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.7 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
 - 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. Fire End & Croker Corporation.
 - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsen's Manufacturing Company.
 - e. Potter Roemer LLC.
 - 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. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

- A. Provide brackets for extinguishers not located in cabinets. Provide manufacturer's standard brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

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 in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 105300
PROTECTIVE COVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, of these Specifications, apply to work specified in this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Prefabricated Canopy system; including frames, drainage system and roof deck assembly.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install covered walkway system to withstand the structural loads required under the State Building Code without exceeding the allowable design working stresses of the materials involved, including anchors and connections.

1.4 SUBMITTALS

- A. Product Data: Submit for each type of protective cover and accessory indicated. Indicate roof panel type, fascia profile, framing components and accessories.
- B. Shop Drawings: Submit shop drawings indicating layout of covered walkway coordinated with field measurements and including frame heights, roof slopes, overall dimensions, connections and relationship to adjoining work, accessories, types of materials, and finishes. Indicate work by others required for complete installation.
- C. Certification: Submit design calculations prepared and sealed by registered (structural) Professional Engineer licensed in the State of Virginia indicating structure complies with wind criteria of ANSI/ASCE 7-88, stability and loading requirements of building code and all other governing criteria.
- D. Color Samples: Submit printed or coated metal samples of complete color range offered for Architects selection.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer to perform unit of work of this section who has specialized in the installation of types of protective covers similar to that required for this project and who is acceptable to, or certified by, manufacturer of protective covers.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" and D1.3 "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual dimensions of construction affecting protective covers by accurate field measurements before fabrication; show

recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Provide approved layout drawings and column base inserts or form-outs for installation of concrete foundations.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Peachtree Protective Covers, Inc.
 - 2. Dittmer Architectural Aluminum
 - 3. Mapes Architectural Products
 - 4. Perfection Architectural Systems Inc.
 - 5. Superior Metal Products Co.

2.2 MATERIALS

- A. Aluminum Sheet: ASTM B 209
- B. Aluminum Tubing: ASTM B 429, 6063 - T6, schedule 40.
- C. Aluminum Extrusions: ASTM B 429, 6063 - T6.
- D. Cast Aluminum (end caps): 319 alloy.
- E. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 CONSTRUCTION

- A. Smoothly round corners, edges, and exposed fasteners to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.

2.4 COVERED WALKWAY

- A. General: Provide manufacturer's standard prefinished metal roofing covered walkway system fabricated to comply with requirements indicated. Provide all roof deck, fascia, and frames ("bents") consisting of beams and columns with integral (internal) rainwater drainage system. Include all accessories, closure and trim pieces, anchors and connection devices required for complete assembly.
- B. Frame Height: as indicated on drawings.
- C. Support Structure: All structural fabrication shall be extruded anodized aluminum sections made of 6063-T6 aluminum alloy, and having a minimum wall thickness of 0.125 inches. Provide frames ("bents") fabricated from anodized beams and columns as either all-welded rigid frames or mechanically joined sections as determined by manufacturer (fabricator) and in accordance with final shop drawings. Provide column sleeves for presetting into concrete foundation structure.
 - 1. Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and

fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.

2. Provide frame configuration indicated for installation, including those required for angled or corner conditions.
 3. Provide extruded aluminum wall angle for wall supported applications as indicated.
- D. Extruded Aluminum Roof Deck: Provide interlocking structural deck system fabricated of anodized 6063-T6 aluminum alloy and having a minimum wall thickness of 0.065 inches. All splices shall occur at supports; splices in other locations will not be permitted.
1. Provide manufacturer's standard 3-1/2" deep flat bottom deck section for flat soffit.
 2. Provide manufacturer's standard anodized extruded aluminum fascia of profile indicated.
 3. Metal Roofing Finish: Provide factory applied 2-coat, thermocured coating system ("Kynar") composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; conforming to AAMA 2605 (formerly 605.2). Finish color will be selected from manufacturer's full range of color offerings.
 4. Hardware: All connections shall be made with standard corrosion resistive fasteners.
 5. Drainage: Internal drainage in column shall connect to site drainage below grade. Provide 3" diameter aluminum pipe extension welded to column.

2.5 FOUNDATIONS FOR COVERED WALKWAYS

- A. Provide concrete foundations complying with criteria specified in Division 03, "Cast-in-Place Concrete." Footings for the bent frame assembly shall provide sufficient bearing area at the bottom to support all loads of the covered walkway. Footing design is based on 3,000 PSF allowable soil pressure unless otherwise instructed in the soil data, such as, but not limited to, adverse soil conditions, high water table, underground obstructions and other conditions, to permit bidders reasonable evaluation of the site conditions. Foundation concrete shall attain minimum working strength of 3,000 pounds per square inch at 28 days.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install protective covers to comply with manufacturer's instructions and final shop drawings. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installation of units and permanent attachment of units to adjoining construction.
- B. Adjust frames prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and wall angles to building construction as follows:
 - 1. Anchor posts in concrete by means of column sleeves preset and anchored into concrete. Insert posts into sleeves, and fill annular space between post and sleeve solid with non-shrink nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. For installations exposed on exterior, or to flow of water, seal anchoring material to comply with grout manufacturer's directions.
 - 2. Anchor wall angles into wall construction with lead expansion shields and bolts or alternate expansion devices sufficient to support loading.

3.2 CLEANING AND PROTECTION

- A. Clean installed protective covers on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that protective covers are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 107500
FLAGPOLES

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 ground-set flagpole made from aluminum.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
 - 1. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
 - 2. Basic Wind Speed: 90 mph ; 3-second gust speed at 33 feet aboveground.

1.4 SUBMITTALS

- A. Product Data: For each type of flagpole required.
- B. Shop Drawings: Include elevations and details showing general arrangement, jointing, fittings and accessories, grounding, and anchoring and supporting systems.
 - 1. Include details of foundation system for ground-set flagpoles.
- C. Finish Samples for Verification: For each finished material used for flagpoles and accessories.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.
 - 1. Obtain flagpoles through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Flagpole; a Kearney-National Inc. Company.
 - 2. Baartol Company Inc. (The)
 - 3. Concord Industries, Inc.
 - 4. Eder Flag Manufacturing Company, Inc.
 - 5. Ewing International.
 - 6. Lingo Inc.; Acme Flagpole Division.
 - 7. Michigan Flagpole Inc.
 - 8. Morgan-Francis Div.; Original Tractor Cab Co., Inc.
 - 9. Pole-Tech Company Inc.

2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 - 2. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- B. Exposed Height: 25 feet.
- C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241, Alloy 6063, with a minimum wall thickness of 3/16 inch. Heat treat after fabrication to comply with ASTM B 597, Temper T6.
- D. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch- minimum nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 - 1. Provide flashing collar of same material and finish as flagpole.

- 2.3 Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

2.4 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch spun aluminum, finished to match flagpole.
- B. External Halyard: Ball-bearing, non-fouling, revolving truck assembly of cast metal with continuous 5/16-inch- diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 - 1. Provide two halyards and two cleats at each flagpole.
- C. Halyard Flag Snaps: Provide two bronze swivel snap hooks per halyard.
 - 1. Provide with neoprene or vinyl covers.
- D. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.
 - 1. Product: Subject to compliance with requirements, provide "Quiet Halyard Flagclasp" by Lingo Inc.; Acme Flagpole Division.

2.5 MISCELLANEOUS MATERIALS

- A. Concrete: 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 3000 psi
- B. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain a 28-day compressive strength of not less than 3000 psi , complying with ASTM C 94/C 94M.
- C. Sand: ASTM C 33, fine aggregate.
- D. Elastomeric Joint Sealant: Single-component urethane joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.6 FINISHES

- A. Metal Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating:

Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.
- D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 108213 ROOF SCREENS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Stand-alone roof equipment screens and supporting steel framework. Screens shall be designed to attach to the roof structure and not the equipment being screened.

1.2 REFERENCES

- A. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- E. ASTM A 1057 - Standard Specification for Steel, Structural Tubing, Cold Formed, Welded, Carbon, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- G. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing.
- H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
- I. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- K. AWS D1.1 - Structural Welding Code - Steel.
- L. AWS D1.6 - Structural Welding Code - Stainless Steel.

1.3 COORDINATION

- A. Coordinate Work with other operations and installation of roofing materials to avoid damage to installed insulation and membrane materials.

1.4 ACTION SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Layout and erection drawings showing typical cross sections and dimensioned locations of all frames and base supports. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Selection 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, minimum size 6 inches (150 mm) square, representing actual product, shape, and patterns.

1.5 INFORMATIONAL SUBMITTALS

- A. Design Calculations: 3 copies of structural design calculations for structural components and components resisting wind loads with seal and signature of professional engineer licensed in the State of Virginia.
- B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- D. Warranties: 3 signed copies.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum five years documented experience in producing pre-manufactured metal-framed equipment screens.
- B. Design Qualifications: Provide structural design calculations stamped by a professional engineer licensed in the state in which this project is located.
- C. Welders: AWS certified within previous 12 months.
- D. Pre-Installation Meeting:
 - 1. Convene at job site, at least seven calendar days prior to scheduled beginning of construction activities of this section, to review requirements of this section.
 - 2. Require attendance by representatives of the installing subcontractor (who will represent the system manufacturer), the mechanical subcontractors and other entities affected by construction activities of this section.
 - 3. Notify Architect four calendar days in advance of scheduled meeting date.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the project site clearly marked for proper identification.
- B. Receive, handle and store materials in conformance with the manufacturers printed instructions.
- C. Store products under cover, in manufacturer's unopened packaging until ready for installation.
- D. Protect materials from exposure to moisture.
- E. Store materials in a dry, warm, ventilated weathertight location.
- F. Protect metal fabrications from damage by exposure to weather.
- G. Handling: Use a forklift or crane to move material. Do not lift the bundles by the metal bands.
 - 1. Fork Lift: Spread the forks as far as possible to balance the load. Drive slowly when moving long bundles over uneven surfaces to avoid tipping the load
 - 2. Crane: Position the canvas sling straps so that the space between the straps is at least 1/3 the length of the bundle. Use sling straps with looped ends running one end of the strap through the loop at the other end to cinch the bundle when lifted. When setting the load on the roof, put wood blocks under it to protect the roof and allow space to remove the sling straps.
 - 3. Roof Placement: Spread the bundles and crates out as much as possible to avoid overloading the roof structure. Place the material directly over major supports such as beams or trusses.
 - 4. Position bundles of tubing parallel to the slope of the roof and block prior to opening to prevent the tubing from rolling down the roof slope when unbundled.

1.8 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.
- B. Field Measurements: Verify roof screen dimensions and conditions of the installation 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 equipment enclosure without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 WARRANTY

- A. Framing System: Provide manufacturer's standard written limited warranty stating that the complete framing system shall be warranted against structural failure due to cracking, buckling, bending, tearing or corrosion arising under normal use and environmental conditions for the coverage period applicable.
 - 1. Products installed on shall be warranted for twenty (20) years
- B. Panel Finish:
 - 1. Provide written warranty stating that the paint finish applied on all equipment enclosure panels will be warranted against chipping, peeling, cracking, fading, or blistering for the coverage period of twenty (20) years.
- C. The above warranties are in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design Loads: Comply with Building Code for site location and building height.
 - 1. Design to resist ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
 - 2. Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.
- B. Structural Design: Prepare structural design calculations for screen framing and attachment to structure including reactions at base supports for verification of roof structure by Architect.
- C. All welds to be performed by an AWS certified welder. Valid certification to be provided.

2.2 MANUFACTURERS

- A. Basis of Design Manufacturer: RoofScreen Mfg.
- B. Other Manufacturers:
 - 1. Architectural Louvers.
 - 2. Ametco Manufacturing.
 - 3. Atas International, Inc.

2.3 MATERIALS

- A. Round Post Supports: 60 inch (305 mm) tall weldments fabricated from galvanized steel tube conforming to ASTM A 500 and cold rolled steel plate conforming to ASTM A36, fabricated with pre-punched holes in base plate for fastening to roof structure. After fabrication, apply minimum 2 to 4 mil shop primer to base plate and weld. Provide height adjustment with galvanized tube sleeve conforming to ASTM A 500, sized to telescope over outside of round post tube and fastened at

desired height with self-drilling, self-tapping screws.

- B. Round Post Cap: Weldments fabricated from AISI Type 304 stainless steel with mill finish fabricated to slip over 2-1/2" sleeve tube allowing adjustable height when used with Round Post Support.
- C. Round TPO Roof Flashing: Fabricated from 60 mil, single ply TPO sheet conforming to ASTM D 6878. Provide with base flange that extends a minimum of 5 inches (127 mm) onto the roof surface on all four sides. Hot weld all seams for water tightness.
- D. Roof Flashing: Refer to Division 07 section that specifies the roof membrane.
- E. Base Cap Gasket: EPDM with self-adhesive closed cell foam.
- F. Framing: Carbon steel structural tubing in manufacturer's standard sizes, conforming to ASTM A 500 with manufacturer's standard galvanized coating conforming to ASTM A 1057. Provide with wall thickness as determined by structural calculations.
- G. Connector Fittings: Fabricated from AISI Type 304 stainless steel with mill finish.
- H. Steel Hat Channel: Steel sheet conforming to ASTM A 653, Class SS, with a G90 hot-dip galvanized coating.
- I. Hardware: Bolts, nuts and washers: 18-8 stainless steel.
- J. Self-Drilling Screws: Carbon steel with factory applied protective coating conforming to ASTM B 117 salt spray testing.
- K. Welding Materials: AWS D1.1; type required for materials being welded.
- L. Panel:
 - 1. Profile: 7.2 Rib Panel.
 - 2. Base Metal:
 - a. Minimum 24 gauge Galvalume steel sheet, AZ50, conforming to ASTM A 792 for painted and unpainted panels.
 - b. PVDF fluoropolymer, 1 mil, 2 coat, 70 percent.
 - c. Color as selected by Architect from manufacturer's standard color range, 20 colors minimum.
 - d. Coat reverse side with off-white primer coat.
 - 3. Panel Fasteners: No. 14 self-tapping sheet metal screw. Color coat heads to match panel color.
 - 4. Panel Trim: Same material and finish as panel. Configuration as shown on Drawings

2.4 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- E. Fabricate system components so that portions of screen can be dismantled for repairs to equipment being screened and for future roof replacement.
- F. Trim and Closures: Fabricated from 24 gauge metal and finished with the manufacturer's standard coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area where work will be installed to verify the installation can be performed in accordance with the Drawings and structural calculation requirements without interference from other equipment or trades.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Do not begin installation until conditions have been properly prepared.

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 in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- D. Anchor fabrications to structure as indicated.
- E. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape to eliminate possibility of corrosive or electrolytic action between metals.
- F. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.
- G. Install flashing boots at base supports as required to provide a watertight connection. Install as recommended by the roof membrane manufacturer.
- H. Remove all protective masking from material immediately after installation.

3.4 CLEANING AND PROTECTION

- A. Remove all protective masking from framing and trim material immediately after installation. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Maintain in a clean condition during construction.
- B. Protect installed products until completion of project.
 - 1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.
 - 2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.
- C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.
- D. Replace metal wall panels and framing members that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 122400 WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware.
- B. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.
- C. UL GREENGUARD Gold.
- D. US Green Building Council.
- E. ANSI/WCMA A100.1-2022.
- F. Window Covering Safety Council Best for Kids™.
- G. ANSI/WCMA A100.1-2022. For manual window shades with closed loop bead chains, all shades will meet all current standards mandated by the Consumer Product Safety Commission.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01330 [01 33 26] - Submittal Procedures:
- B. Product Data: Manufacturer's data sheets on each product specified, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation and maintenance instructions.
 - 3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, and operating instructions.
 - 4. Storage and handling requirements and recommendations.
 - 5. Mounting details and installation methods.
 - 6. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual, and lighting control systems as applicable.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams, and relationship to adjacent work.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.
- E. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements.

Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

- G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- I. Standard manufacturer's defect warranty: Standard manufacturer's warranty documents indicating compliance with requirements of Section 1.9 below.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years' experience in manufacturing products comparable to those specified in this section. Manufacturers that do not meet the required experience requirements must submit life cycle test data showing minimum 2000 complete operational cycles for each year of warranty showing no failure and that shade remains fit for use as an operable shade).
- B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use. Show complete manufacturer data (name, location, contact) and certification from manufacturer that the fabrics sourced for this project comply with the test data provided.
- C. Mock-Up: Provide a mock-up of one of each type of roller shade assembly specified for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window(s) designated by Architect.
 - 2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
- B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
- C. Label containers and shades according to Window Shade Schedule.
- D. Store products in manufacturer's unopened packaging until ready for installation.

1.6 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.7 PROJECT CONDITIONS

- A. Install roller shades after finish work and ambient temperature, humidity, and ventilation conditions are maintained at levels recommended for project upon completion.

1.8 WARRANTY

- A. Hardware and Shade Fabric: Draper standard twenty-five-year limited warranty.
- B. Motors and Controls: Draper standard five-year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Draper, Inc. – Basis of Design
 - 2. Mecho Shade Systems
 - 3. Hunter Douglas
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MOTORIZED WINDOW SHADES

- A. Type: Motorized vertical roll-up, fabric, window shade with motors, controls, mounting brackets, and other components necessary for complete installation; Motorized FlexShade® ST30 DC as manufactured by Draper, Inc.
 - 1. Endcaps and fascia.
 - 2. Endcaps and ceiling/wall headbox.
- B. Shade Motor and Control System
 - 1. Model: ST30 RS 485 Motor - 24V DC quiet motor with built-in intelligence for RS 485 control. Tubular motor concealed inside each shade roller tube. 4 Nm of torque.
 - a. Individual Control, Group Control and Individual and Group Control:
 - 1) 8 button RS 485 switch- for up/stop/down. 5 presets.
 - b. Transformer (24V DC ONLY):
 - 1) Power Panel:
 - (a) 10 Motors.
- C. Configuration:
 - 1. Single Roller.
 - a. Mounting.
 - 1) Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size. Endcap covers to match fascia/headbox finish.
 - 2) Brackets: 1/8-inch-thick stamped steel, black powder coat, idler height adjuster, field adjustable to wall or ceiling mount.
 - (a) Mounted to jamb.
 - 3) Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
 - (a) Attachment: Snaps onto end caps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands.
 - (b) Shape: Square Fascia Panel.
 - (c) Finish: Selected from Manufacturers standard range.
 - 4) Aluminum Light Gap Reduction Channels
 - (a) L Angle - 3/4 inch by 1 inch (19 mm by 25 mm).
 - 5) Interior cable guide kit
 - (a) Interior cable hem bar finial.
 - (b) Cable mount.
 - (c) Cable.

- (d) Tension Stop.
 - 6) Shade slat:
 - (a) Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.
- D. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

2.3 MANUALLY OPERATED WINDOW SHADES

- A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Clutch-Operated FlexShade® NEXD as manufactured by Draper, Inc.
 - 1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
 - a. Clutch mechanism: Molded components from thermoplastic, .118" (3mm) steel baseplate and .354 inch (9 mm) primary carbon steel post are joined via a high tonnage hydraulic swaging process; assembled with a rotational roller bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right- or left-hand operation and accommodates side channel with no adjustment of chain location.
 - 1) Spring-assist bead chain clutch mechanism: Adjustment-free system includes spring-assist components to reduce lifting forces required to raise the shade. Manufacturer shall provide estimated torque for shade unit. Spring-assist is recommended on estimated non-spring-assist torque above 6 lb-in; required on shades with an estimated torque higher than 15 lb-in.
 - b. Bead chain loop: Stainless Steel.
 - c. Bead Chain Hold Down: Spring-Loaded Tensioner complying with ANSI/WCMA A100.1-2022 safety standard. When properly installed, tensioning device shall have 1.5 inches of tolerance to minimize adjustments due to chain stretching, enhancing installation and maintenance ease.
 - d. Idler end: Height adjustable idler end allows fine leveling adjustments after installation-min +/- 1/8" without shimming brackets. Contains at least two entry points for the idler end. Safety engagement feature requires idler end pin to have a minimum engagement in bracket, ensuring that the idler end cannot fall out of the bracket due to lack of pin engagement.
 - 2. Single Roller Configuration:
 - a. Mounting:
 - 1) Endcaps and fascia.
 - 2) Endcap covers: To match fascia or headbox color.
 - b. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
 - 1) Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously

across two or more shade bands. Notching of fascia to provide for chain clearance is NOT acceptable. Fascia height to match throughout space unless specifically approved in advance by Architect.

- 2) Shape: Square Fascia Panel.
 - 3) Finish: Selected from Manufacturers standard range.
 - 4) Provide continuous wall clip, 1-3/4 (44 mm) by 3/16 inch (5 mm), for snap-in attachment of closure panel without fasteners.
3. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.25 inches. Tube diameters less than 1.5" shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to $\leq \frac{\text{width(inches)}}{700}$ at 1.5X design load.
 - a. Fabric to tube attachments
 - 1) Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
4. Shade slat:
 - a. Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.
5. Light Gap Reduction Channels.
 - a. Aluminum L Angle – 3/4 inch (19 mm) by 1 inch (25 mm).
6. Interior cable guide kit.
 - a. Interior cable hem bar finial.
 - b. Cable mount.
 - c. Cable.
 - d. Tension Stop.

2.4 FABRIC

- A. Color and pattern: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- B. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.
- C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
 - 1. Fascias.
 - 2. Closure panels.
 - 3. Endcaps.
- D. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

3.4 TESTING AND DEMONSTRATION

- A. Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.
- B. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

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

3.6 SCHEDULES

- A. Refer to Drawings for shade types and locations.

END OF SECTION

SECTION 123661
SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface countertops.
2. Solid surface material window stools.
3. Quartz agglomerate countertops.
4. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, and attachment to other work.
2. Locations and details of joints.
3. Locations, quantity, and type of supports/brackets.
4. Direction of directional pattern, if any.
5. Locations and sizes of cutouts and holes for items installed in countertop.
6. Apply AWI's Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate locations and sizes of cutouts and holes for items installed in countertops or backsplashes.

B. Qualification Statements: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface countertops to include in maintenance manuals. Include product data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

- 1. Fabricator to perform installation of countertops.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of countertops by field measurements before countertop fabrication is complete and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work..

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Quality Standard: Unless otherwise indicated, comply with ANSI/AWI 1236 for grades of simulated stone countertops indicated for construction, finishes, installation, and other requirements.

2.2 SIMULATED STONE COUNTERTOPS

- A. Solid Surface Countertops ([SS-1]):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Corian Solid Surface or comparable product by one of the following:
 - a. DuPont; DuPont de Nemours, Inc.
 - b. Formica Corporation
 - c. Wilsonart LLC
 - 2. Solid Surface Material: Homogeneous fabrication of mineral fillers and pigments bound together with a matrix of polymers and resins, complying with ISFA 2-01.

- a. Thickness: 1/2-inch .
 - b. Colors and Patterns: As selected by Architect from manufacturer's full range .
- 3. Countertop Grade: Custom .
- 4. Countertop Construction:
 - a. Type: Standard .
 - b. Front Edge: Built up with same material, profile as indicated on Drawings.
 - c. Exposed Edge Treatment: Bevel .
 - d. Provide drip groove 1/8 inch by 1/8 inch set back 3/8 inch from front edge of countertop.
 - e. Backsplash: Detached straight .
 - 1) Height: 4 inches .
 - 2) Thickness: Matching countertop .
 - f. End Splash: Matching backsplash.
- B. Solid Surface Window Stools ([SS-2]):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Corian Solid Surface or comparable product by one of the following:
 - a. DuPont; DuPont de Nemours, Inc.
 - b. Formica Corporation
 - c. Wilsonart LLC
 - 2. Solid Surface Material: Homogeneous fabrication of mineral fillers and pigments bound together with a matrix of polymers and resins, complying with ISFA 2-01.
 - a. Thickness: 1/2-inch .
 - b. Colors and Patterns: As selected by Architect from manufacturer's full range.
 - 3. Grade: Custom .
 - 4. Countertop Construction:
 - a. Type: Standard .
 - b. Front Edge: Built up with same material, profile as indicated on Drawings.
 - c. Exposed Edge Treatment: Bevel .

2.3 ACCESSORIES

A. Grommets:

- 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. Doug Mockett & Company, Inc.
 - b. Hafele America Co.
 - c. W.W. Grainger, Inc.
- 2. Wire Management Grommets: Circular grommets and matching caps with slot for wire passage.
 - a. Finish: Metal .
 - b. Outside Diameter: 2 inches .
 - c. Color: Black .
- 3. Power/Data Grommets: UL-listed recessed grommet.
 - a. Power Outlets: Two .
 - b. USB Charger: 1 dual .
- B. Countertop Support Brackets :
 - 1. Type: Hidden .so
 - 2. Material: Steel .
 - 3. Color: Black powder coat.

2.4 FABRICATION

- A. Fabricate countertops in sizes and shapes required to comply with requirements indicated on Drawings.
- B. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with countertop material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Edge treatment to be eased.
- C. Joints:
 - 1. Fabricate countertops without joints.
- D. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for grommets, plumbing fittings, undercounter

- 4. soap dispensers, and similar items.
- 4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

E. Window Stools

- 1. Install window stools for full length of each window unit, securing to substrates with concealed fasteners and specified adhesive
- 2. Provide minimum 1/8-inch expansion gap on both sides of window stools. Fill gap with specified joint sealant.

2.5 INSTALLATION MATERIALS

- A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- B. Adhesive: Product recommended in writing by countertop material manufacturer.
- C. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive 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 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Examine shop-fabricated work for completion and complete work as required, including removal of packing materials.

3.3 INSTALLATION OF SIMULATED STONE COUNTERTOPS

- A. Grade: Install countertops to comply with specified grade.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts not finished in the shop. 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.

C. Countertop Installation:

1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
4. Install countertops level to a tolerance of 1/8 inch in 8 ft., 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
5. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by countertop material manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with countertop material manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
6. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
7. Secure countertops to subtops with adhesive in accordance with countertop material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with countertop material manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
8. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - a. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
9. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
10. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended in writing by manufacturer.
11. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls. Comply with Section 079200 "Joint Sealants."

3.4 ADJUSTING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

3.5 CLEANING

- A. Clean countertops on exposed and semi-exposed surfaces.

3.6 PROTECTION

- A. Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

SECTION 129300
SITE FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes:
 - a. Site Benches
 - b. Bollards

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not fabricate or deliver items to the site until all specified submittals have been submitted and approved by the Architect.
- B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- C. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- D. Handling: Protect materials and finish during handling and installation to prevent damage.

1.5 WARRANTY

- A. Warranty Information:
 - a. Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - b. Manufacturer shall repair, replace, or refund the purchase price of any items found defective upon inspection.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Provide product from one of the following manufacturers:
 - a. Landscape Forms, Inc.
 - b. Anova Furnishings Inc.
 - c. Site Scapes Inc.
 - d. Belson Outdoor

2.2 SITE BENCH

- A. Basis of Design: Belson Outdoor – Model TF5026 | Concrete Bench
- B. Size: 72”L x 18” W x 16” H
- C. Material: Reinforced Precast Concrete
- D. Signage Option: No Signage
- E. Mounting: Free Standing
- F. Finish: Acid Wash
- G. Color: To be selected from manufacturers standard range of color options by Architect.
- H. Location: As indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive units.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer’s instructions at locations indicated on the Drawings.
- B. Install units level and plumb.
- C. Anchor units, if specified as surface mount, securely in place.

3.3 ADJUSTMENTS

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- B. Do not use harsh cleaning materials or methods that could damage finish.

END OF SECTION

SECTION 142123
HYDRAULIC PASSENGER ELEVATORS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Hydraulic passenger elevators.

1.2 REFERENCES

- A. ANSI/ASME A17.1 – Safety Code for Elevators and Escalators.
- B. ISO 9001-2000 – Quality Management Systems – Requirements.

1.3 DESIGN REQUIREMENTS

- A. Arrange elevator components in machine room so equipment can be removed for repairs or replaced without dismantling or removing other equipment components.

1.4 SUBMITTALS

- A. Comply with Section 013300 - Submittal Procedures.
- B. Product Data: Submit manufacturer/installer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.
- D. Samples: Submit manufacturer/installer's samples of standard colors and finishes of finish materials.
- E. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.
- F. Warranty: Submit manufacturer/installer's standard warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of 5 years successful experience.
- B. Regulatory Requirements:
 - a. Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ANSI/ASME A17.1, handicap accessibility, Americans with Disabilities Act, and other codes having legal jurisdiction.
 - b. ANSI/ASME A17.1 shall govern, except where codes having legal jurisdiction include more rigid requirements or conflict with ANSI/ASME A17.1.

c. Elevator shall follow design and manufacturing procedures certified in accordance with ISO 9001-2000 to meet product and service requirements for quality assurance for new products.

C. Pre-installation Meeting:

- a. Convene pre-installation meeting before start of installation of elevators.
- b. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and elevator manufacturer/installer.
- c. Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer/installer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer/installer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

1.7 PROJECT CONDITIONS

- A. Temporary Electricity:
 - a. Owner will arrange for temporary 3-phase electricity to be available for installation of elevator components.
 - b. Comply with Section 015000 Temporary Utilities.
- B. Temporary Use of Elevator:
 - a. Owner will negotiate with manufacturer/installer for temporary use of elevator, if required.
 - b. Temporary use of elevator shall be in accordance with terms and conditions of manufacturer/installer's temporary acceptance form.

1.8 SCHEDULING

- A. Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.

1.9 WARRANTY

- A. Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.10 MAINTENANCE SERVICE

A. Elevator maintenance service shall be performed by elevator manufacturer/installer.

Elevators shall receive regular maintenance on each unit for period of 12 months after completion of work specified herein or acceptance thereof by beneficial use, whichever is earlier.

B. Trained employees shall make periodic examinations and perform work including necessary adjusting, greasing, oiling, and replacing parts to keep elevators in operation, except parts that require replacement because of accidents, vandalism, misuse, or negligence by parties other than manufacturer/installer.

Manufacturer/installer shall perform all Work, except emergency minor adjustment call-back service, during regular work hours. Manufacturer/installer shall provide emergency minor adjustment call-back service, 24 hours 7 days a week.

C. Should Owner request that examinations, cleaning, lubrication, adjustments, repairs, replacements, or emergency minor adjustment call-back service, unless specified herein, be performed on other than manufacturer/installer's regular working hours of regular working days, manufacturer/installer shall absorb straight-time labor charges and Owner will compensate manufacturer/installer for overtime premium, travel time, and expense at normal billing rates.

D. Elevator Control System:

a. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week central-monitoring facility.

b. Remote Monitoring Device: Transmit information on current status of elevators, including malfunctions, system errors, and shutdown.

E. Maintenance Options

Regular Maintenance: During Regular Work Hours

Callback Service: 24 Hours 7 Days A Week

Maintenance Period: 12

PART 2 – PRODUCTS

2.1 MANUFACTURER/INSTALLER

A. Schindler Elevator Corporation, Website www.us.schindler.com.

B. Elevator shall be installed by elevator manufacturer.

2.2 ELEVATOR SYSTEM AND COMPONENTS

A. Hydraulic Passenger Elevators: Model 330A.

B. Elevator Equipment Summary:

a. Application: Holeless Dual Piston

b. Service: Hospital/service- Class A Loading

c. Quantity: 1 Unit

d. Capacity: 4000 Lbs

- e. Speed: 150 Fpm
- f. Travel: 28' 0"
- g. Landings: 2
- h. Front Openings: 1
- i. Rear Openings: 0
- j. Operation: Microprocessor Single Car Automatic Operation
- l. Machine Room: Adjacent To Elevator Hoistway
- m. Platform Size: 6'-0" Wide X 8'-3" Deep
- n. Door Type: Two Speed Side Opening
- o. Cab Height: 8' 0"
- p. Guide Rails: Equivalent to 16 lb. per foot
- q. Hoistway Entrances: 3'-0" Wide X 7'-0" High SSSO doors
- r. Power Supply: 480 Volts 3 Phase 60 Hz

C. Elevator Components:

- a. Anti-stall feature.
- b. Braille and audible signals.
- C. Door open and close stall protection.
- d. Emergency lighting.
- e. Firefighter's Service: Sensors as specified
- f. Independent service feature.
- g. Infrared light curtain door protection.
- h. Low oil return.
- i. Overload sensors.
- j. Phase protection.
- k. Soft Start Electronic Starting
- l. Elevator Management System Provisions.
- m. Button Access Code.
- n. Card Reader Provision.
- o. Emergency Power.
- p. Future Car Provision.
- q. Future Floor.
- r. Hoistway Access Switch at floors N/A
- s. Heat Exchanger.

- t. Heater for Power Unit.
- u. Locking Service Panel in Car Operating Panel.
- v. Parking at floors 123.
- w. Power Unit Noise Reduction.
- x. Pressure Switch.
- y. Pressure Switch.
- z. Remote Monitoring Capable.
- aa. Battery powered lowering Rescue Feature.
- ab. Status Panel Indicator.
- ac. Telephone (ADA compliant).
- ad. Vandal Resistant Hall Fixtures.

2.3 ELEVATOR MATERIALS

A. Finish:

- a. Stainless Steel and Bronze: #4 satin or #8 mirror finish.
- b. Baked Enamel Colors: Manufacturer/installer's standard color selections.
- c. Exposed Aluminum Frames in Suspended Ceilings: Anodized.

B. Plastic Laminates:

- a. Type: General purpose.
- b. Flame Spread Ratings: As required by code.
- c. Pattern: Select from elevator manufacturer/installer's standard selection.

C. UL or CSA Approved: Motors, pumps, valves, fluid tank, hydraulic fluid, microprocessor controller, controls, pushbuttons, and wiring.

D. Spring Buffers, Attachment Brackets, and Anchors: Design and size according to building code with safety factors.

E. Pump: Positive displacement screw type, design for steady discharge with minimal pulsations.

F. Muffler: Reduce noise transmission.

G. Telescopic Holeless Jack System:

- a. Jack Cylinder: Two jacks, one located at each side of the car and mounted to the elevator car structure.
- b. Synchronization of Jack Stages: Direct mechanical means to ensure elevator moves at steady speed and provides smooth ride.

2.4 ELEVATOR CABS

Height: 8' 0" from finished floor to underside of canopy.

A. Elevator Car Enclosure Wall Sections:

- a. Cab Wall: Steel - Painted Finish.
- b. Base, Frieze, and Reveals: None.

B. Ceiling:

- a. Suspended with Concealed Frame Finished In #4 Stainless Steel.
- b. Lighting: Downlight Ceiling.

C. Cab Returns: Integral construction.

Finish: #4 Stainless Steel.

D. Transoms:

- a. Run full width of cab.

Finish: #4 Stainless Steel.

E. Cab Doors:

- a. Flush design both sides.
- b. Rib construction.

Finish: #4 Stainless Steel.

F. Exhaust Fan:

- a. Single speed.
- b. Mount in cab transom or canopy.

G. Handrail:

1/2" X 2" Flat In #4 Stainless Steel.

Mount on Rear & Side Walls.

Threshold: Aluminum.

H. Cab Finish Flooring: As specified

Furnish 1set(s) of quilted, soil resistant and fire-retardant pads with appropriate fasteners.

- a. Provide certificate frame.

2.5 HOISTWAY ENTRANCES

A. Hoistway Doors and Frames:

- a. UL rated with required fire rating.
- b. Doors: Rigid flush panel construction with sound-deadening material.

Frames: Securely fasten at corners to form unit frame. Frames shall be Bolted.

Exposed Areas of Corridor Frames: #4 Stainless Steel - All Floors

Doors: #4 Stainless Steel - All Floors

Sills: Aluminum

2.6 CAB FIXTURES

A. Main Car Operating Panel:

- a. Mount in return.
- b. Comply with handicap requirements.
- c. Include pushbuttons and illuminating indications for each floor served.
- d. Emergency Buttons and Switches: Provide in accordance with code.
- e. Switches for car light and accessories.
- f. Mount in return.
- g. Comply with handicap requirements.
- h. Include pushbuttons and illuminating indications for each floor served.
- i. Emergency Buttons and Switches: Provide in accordance with code.
- j. Switches for car light and accessories.
- k. Mount in return.
- l. Comply with handicap requirements.
- m. Pushbuttons: Illuminate using long-lasting LED's included for each floor served.
- n. Emergency Buttons and Switches: Provide in accordance with code.
- o. Switches for car light and accessories.

B. Cab Fixtures:

- a. Car Lantern(s).
- b. Digital Car Position Indicator.
- f. Certificate Frame.
- g. Telephone (ADA compliant).

2.7 HALL FIXTURES

A. Pushbuttons:

- a. Up button and down button at intermediate floors.
- b. Single button at each terminal floor.
- c. Height: Comply with handicap requirements.

Digital Hall Position Indicator: At floors 123.

Hall Lantern: At floors 123.

Hall Fixture Finish: #4 Stainless Steel.

B. Fixture Cover Plates: Mount with tamper-resistant screws in same finish as fixture.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine hoistways, hoistway openings, pits, and machine rooms before starting elevator installation.

B. Verify hoistway, pit, machine room, and openings are of correct size, within tolerances, and are ready for work of this section.

C. Verify walls and sill supports are plumb, where openings occur.

Verify hoistway is clear and plumb, with maximum variation of 1/2" at any point.

D. Verify minimum 2-hour fire-resistance rating of hatch walls.

E. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.

F. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.

3.2 INSTALLATION

A. Install elevators in accordance with manufacturer/installer's instructions and ANSI/ASME A17.1.

B. Set entrances in vertical alignment with car openings, and aligned with plumb hoistway lines.

3.3 FIELD QUALITY CONTROL

A. Perform tests of elevator as required by ANSI/ASME A17.1 and governing codes.

3.4 ADJUSTING

A. Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.

B. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.

C. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.

D. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.

E. Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.

F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.5 CLEANING

A. Clean elevators promptly after installation in accordance with manufacturer/installer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

A. Protect installed elevators from damage during construction.

END OF SECTION

SECTION 220000
PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specifications shall be applicable to all phases of plumbing work covered by specifications and drawings issued for this project.
- B. The "General Conditions of the Contract," "Supplementary General Conditions," and all other similar general requirements issued for this project shall apply to all plumbing work and are hereby made a part of this section.
- C. The Contractor and/or his representatives shall be fully acquainted with the design and operation of the systems and equipment described in these specifications and on the drawings.
- D. Work included under this section shall include complete systems as shown on the plans and as specified. Provide supervision, labor, material, equipment, machinery, plant, and other items necessary to complete the plumbing systems. It is the intention of these specifications and drawings to call for finished work, tested, and ready for operation.
- E. Definitions:
 - 1. "Owner" and "Contractor" shall mean the respective parties to the prime contract governing the project. Only one contractor is recognized as a party to this contract. Where the terms "Plumbing Contractor" or "Subcontractor" are used, it is for convenience only.
 - 2. "Architect/Engineer" shall mean the firm and authorized representatives of the firm engaged by the Owner for architectural and engineering services related to this project.
 - 3. "Plumbing" shall mean all work related to plumbing systems including sanitary and storm drainage, domestic water, gas, compressed air, fuel oil, and similar systems, including all related components, accessories, controls, and miscellaneous work required for a complete system.
 - 4. "Contract Documents" shall mean and include the agreement, the drawings and specifications and all modifications thereto authorized by the Owner in writing prior to final completion of the project.
 - a. The term "Agreement" shall mean the completed and signed contract form.
 - b. The term "Drawings" shall mean the drawings prepared by the Architect/Engineer for specific use in bidding and execution of the work.
 - c. The term "Specifications" shall include the legal and procedural documents, the general conditions, special conditions, and the technical specifications.
 - d. The term "Technical Specifications" shall mean that part of the specifications which describes, outlines, and stipulates the kind and quality of the materials to be furnished, the quality of workmanship required, and the methods to be

used in the construction under the contract. For convenience, the plumbing portions of the technical specifications are arranged into one general section and several detailed sections related to the various trades represented in the work. Such arrangement and references shall not operate to make the Architect/Engineer an arbiter in establishing the limits of any subcontract or trade.

5. "Work" of the Contractor shall mean labor or materials or both.
6. "As shown," "as indicated," "as detailed," or words of similar import shall mean reference to the drawings included in the contract documents, unless stated otherwise.
7. "As directed," "as required," "as permitted," "approved," or words of similar import shall mean that the direction, requirement, permission, approval, or acceptance of the Architect/Engineer is intended unless stated otherwise.
8. "As necessary" shall mean that which is necessary to achieve satisfactory completion of the work in order to provide the intended function and form of the project in compliance with the contract documents.
9. "Provide" shall mean "provide complete and in place," that is "furnish and install," ready for beneficial occupancy by the Owner. Except where stated otherwise, description of any work in the contract documents shall mean that the work shall be provided by the Contractor, even though the words "provide" or "furnish and install" do not accompany the description.
10. "Similar" shall be interpreted in a general sense and not as meaning identical, and all related details shall be worked out in respect to their location and their connection with other parts of the work.
11. Exposed: Piping and equipment exposed to view in finished rooms.
12. Option or Optional: Contractor's choice of an alternate material or method.
13. "Sprinkler" shall mean all work related to fire suppression systems including sprinkler, standpipe, fire pump, and similar work, including all related components, accessories, controls, and miscellaneous work required for a complete system.

1.2 INTENT OF CONTRACT DOCUMENTS

- A. The contract documents are complementary, and what is called for in one place shall be as binding as if called for in all places. Where variances occur between drawings and specifications or within either document itself, include in the contract price the item or arrangement of better quality, greater quantity, or higher cost. Agreement shall take precedence over the specifications and drawings. Figured dimensions shall be used in preference to scaling the drawings. In case of conflict between large and small scale drawings, the large scale drawings shall govern.
- B. The plumbing drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The plumbing work shall conform to the requirements shown on the plumbing drawings. Architectural and structural drawings shall take precedence over plumbing drawings. Because of the small scale of the plumbing drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the

work and shall arrange his work accordingly, providing such fittings, valves, boxes, offsets, transitions, and other accessories as may be required to meet such conditions.

1.3 CODES AND STANDARDS

- A. All materials and workmanship shall comply with all applicable codes, state and federal laws, local ordinances, industry standards, utility company regulations, and all other criteria which normally apply to work of this nature.
- B. In case of difference between building codes, state laws, federal laws, local ordinances, industry standards, utility company regulations, other criteria and the contract documents, the more stringent regulations will apply. The Contractor shall promptly notify the Architect/Engineer in writing of any such difference.
- C. If the Contractor performs any work that does not comply with these contract documents or the requirements of the applicable building codes, state laws, local ordinances, industry standards, utility company regulations, and other applicable criteria, he shall bear all costs arising in correcting the deficiencies.
- D. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed in these specifications. The manufacturer and trades involved shall be familiar with the application of these standards.
- E. Applicable codes and standards shall include, but are not necessarily restricted to, the most recently recognized issues of the following:
 - 1. Building Codes:
 - a. Virginia Uniform Statewide Building Code
 - b. International Plumbing Code and accumulative supplements.
 - 2. Industry Standards, Codes, and Specifications:
 - a. AASHO American Association of State Highway Officials
 - b. ABA Architectural Barriers Act
 - c. ADA Americans with Disabilities Act
 - d. AGA American Gas Association
 - e. ANSI American National Standards Institute
 - f. ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers
 - g. ASME American Society of Mechanical Engineers
 - h. ASPE American Society of Plumbing Engineers
 - i. ASSE American Society of Sanitary Engineering
 - j. ASTM American Society of Testing and Materials
 - k. AWS American Welding Society
 - l. CISPI Cast Iron Soil Pipe Institute
 - m. CSA Canadian Standards Association
 - n. AWWA American Water Works Association
 - o. FS Federal Specification

p.	MSS	Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
q.	NBS	National Bureau of Standards
r.	NEC	National Electrical Code
s.	NSF	National Sanitation Foundation
t.	PDI	Plumbing & Drainage Institute
u.	UL	Underwriters' Laboratories, Inc.
v.	UFAS	Uniform Federal Accessibility Standards (2012)

1.4 GOVERNMENTAL FEES, PERMITS, AND INSPECTIONS

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall obtain and pay for all required licenses, permits, charges for connections to outside services, fees and inspections. Upon completion of the work under each section of the detailed plumbing specifications, the Contractor shall furnish a certificate of final inspection to the Architect/Engineer from the governmental inspection department having jurisdiction.

1.5 VISITING THE SITE

- A. Each Contractor shall be responsible for visiting the site before bidding the job to familiarize himself with all existing conditions to be met in the execution of the work under this contract. No additional compensation will be allowed for any changes which may be required to make because of site conditions.

1.6 QUALITY ASSURANCE

- A. Product Criteria:
 1. All materials shall be new and shall bear the manufacturer's name, trade name, and the UL label in every case where a standard has been established for this particular material. The equipment to be furnished shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design. All equipment shall bear a permanent and legible factory-applied nameplate to permit identification of manufacturer, model number and type of unit.
 2. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Architect/Engineer, reasonably close to the site.
 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer to provide for uniform appearance, operation, and maintenance.
 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- B. Manufacturers' directions shall be followed in the delivery, storage, protection, and installation of all equipment and materials. The Contractor shall promptly notify the Architect/Engineer in writing of any conflict between any requirements of the contract documents and the written instructions before proceeding with the work. If the Contractor performs any work that does not comply with the manufacturers' directions or such written

instructions from the Architect/Engineer, he shall bear all costs arising in correcting the deficiencies.

- C. Factory Start-up by the manufacturer's Factory Certified Representative shall be provided where required for each water heater or other equipment specified to have factory start-up. Letters signed by the Representative stating that their equipment has been started, tested, and is operating safely shall be submitted to the Owner as part of the bound Operations and Maintenance Instructions manual specified in section 2.10 CATALOG DATA FOR OWNER of this specification.

1.7 BIDDING INSTRUCTIONS

- A. Products are generally specified by a performance specification and/or by manufacturer's name and model number or trade name.
- B. When specified only by a performance specification, the Contractor may use any manufacturer who meets the performance specification and applicable codes. (The Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS.)
- C. When several products/manufacturers are specified together, then the Contractor has the option of using any product/manufacturer listed. The Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS. The Contractor's bid shall be compiled on the use of the listed products without exception. Substitutions will only be considered after the contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS.
- D. When several products/manufacturers are specified together and the system design is based on one of the listed products by specific model number(s) or catalog number(s), then the Contractor has the option of using the one specific product or any other product/manufacturer listed. In either case, the Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS. However, when the other listed product/manufacturer is used, the Contractor shall be responsible for determining that the product(s) will be compatible with building design, electrical design, plumbing design, and the product(s) will not necessitate design modifications by the Architect/Engineer. The Contractor's bid shall be compiled on the use of the listed products without exception. Substitutions will only be considered after the Contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS. If the products/manufacturers are listed to be "only," then substitutions will not be considered.
- E. When only one manufacturer's name is listed, this shall be the basis of the bid. The Contractor's bid shall be compiled on the use of the listed product. Substitutions will only be considered after the Contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS.

1.8 SUBSTITUTIONS

- A. Substitutions will not be considered during the bid.

- B. After the Contract has been executed, the Architect/Engineer will consider a formal request for a review of substituted products in place of those specified, under the following conditions:
1. Not later than 30 days from the Contract Date, the Contractor shall provide a list of products proposed as substitutions, including the name, manufacturer, and section of the specifications governing the product.
 2. The request shall be accompanied by accurate cost data on the proposed substitutions indicating whether or not a modification of the Contract Sum is to be considered.
- C. Substitutions are understood to mean that the installing Contractor:
1. Has personally investigated the proposed substitute and has determined that it is equal or superior in all respects to the item specified;
 2. Will provide the same guarantee for the substitution that he would for the item or equipment specified;
 3. Certifies that the cost data is complete and includes all related costs under this Contract, and waives all claims for additional cost related to the installation of the accepted substitute;
 4. Has coordinated the installation of the substitute, providing design modifications and changes as required for the work to be complete in all respects;
 5. Has coordinated the installation of the substitute with the General Contractor pertaining to changes required for the work to be complete with all trades and all changes shall be provided without additional cost to the Owner.
- D. The acceptance by the Architect/Engineer of any or all of those substitute items listed by the Contractor for review shall not constitute an approval of the substitute but shall mean that the Contractor may then submit detailed shop drawings for review.
- E. When a request for substitution is granted, shop drawings will be reviewed by the Architect/Engineer. Shop drawings not complete with proper review information will not be reviewed and will be returned unchecked. If after two submittals, the substitute equipment is not approved, the specified equipment shall be provided.

1.9 SHOP DRAWINGS

- A. Shop Drawings are required for all material and equipment that is specified by a manufacturer's name or as indicated in the technical specifications. Furnish the number of copies required by the General and Special Conditions of the Contract, preferably one digital (pdf) copy. Submittal data for related equipment (equipment in the same specification section) shall be submitted at one time **and shall be submitted as a digital file (pdf)**. Allow 10 business days for review of shop drawing submittals, starting from the date LPA, Inc. receives the submittals.
- B. Substitutions will not be considered if:
1. They are indicated or implied on shop drawing submissions without information specified in 1.8 - SUBSTITUTIONS.

2. They require a substantial revision of the Contract Documents in order to accommodate their use.
- C. Identify submittals with PROJECT NAME and NUMBER, CONTRACTOR'S NAME, SECTION NUMBER & NAME, and PARAGRAPH NUMBER of SPECIFICATION GOVERNING, MANUFACTURER, MODEL or STYLE, and CONTRACTOR's REVIEW STAMP. Submittals shall be detailed, dimensioned drawings showing construction, size and arrangement, service clearances, performance characteristics, and capacity. Submittals not properly identified or containing information of a general nature will not be reviewed and will be returned unchecked.
 - D. Where submittals are provided that include multiple types or styles of the specified item and/or multiple options, THE EXACT ITEM AND OPTIONS BEING SUBMITTED SHALL BE CLEARLY MARKED ON THE SUBMITTAL SHEET.
 - E. Submittals shall include manufacturers' standard warranty information for the products being submitted.
 - F. Acceptance of shop drawings shall not be considered as a guarantee of measurements or building conditions. Acceptance shall not relieve the Contractor from the responsibility or necessity of furnishing material or performing work required by the drawings and specifications. Submittal data on any one item shall not be reviewed more than three (3) times. If not accepted after the third review, the Contractor shall provide the equipment upon which the design was based.
 - G. Failure to submit shop drawings in ample time for checking shall not entitle an extension of contract time, and no claim for extension by reason of such default will be allowed.
 - H. No material or equipment, for which submittals are required, may be delivered to or installed at the job site until submittals have been accepted.
 - I. Unless a specific finish is indicated in the contract documents, wherever a choice of finish is available for the specified item, submit accurate color chips or charts to the Architect for review and selection.
- 1.10 PLUMBING REQUEST FOR INFORMATION (RFI's)
- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 for RFI definitions, requirements, and procedures. All plumbing and sprinkler RFI's will require up to 5 business days for review, starting from the date LPA, Inc received the RFI's.
- 1.11 PLUMBING SUBMITTALS
- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 for RFI definitions, requirements, and procedures. All plumbing and sprinkler submittals will require up to 10 business days for review, starting from the date LPA, Inc. received the submittals.

PART 2 – PRODUCTS

2.1 DRIVE GUARDS

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.
- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- C. Access for Speed Measurement: One inch diameter hole at each shaft center.
- D. Lubrication: Guards shall not interfere with lubrication of equipment.

2.2 PAINTING

- A. General - Paint plumbing equipment and material in Equipment Rooms and utility type areas and located outside of the building or on the roof. Painting of equipment and material in finished rooms or areas shall be accomplished as described in PAINTING Section of the Architectural Specifications. Painting in concealed spaces shall be limited to equipment and materials not otherwise protected from rusting such as hangers and supports. Paint shall be products of Sherwin-Williams, Pittsburgh, or Pratt-Lambert. All paints, finishes and coatings shall comply with Green Seal Standards GS-03, GS-11, and SCAQMD Rule #1113 VOC limits for paints and coatings.
- B. Workmanship - The work shall be accomplished by workmen skilled in the painting trade after testing is complete and systems are ready for operation. Surfaces to be painted shall be completely dry before applying paint. Surfaces shall not be painted when the temperature is below 50 Deg. F or above 120 Deg. F, or when they are exposed to hot sun. Materials shall be evenly spread and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coat. The painters shall protect adjacent surfaces with drip covers during the process of painting. Upon completion, paint spots, if any, shall be removed from adjacent surfaces.
- C. Preparation of surface - Metal surfaces shall be cleaned with solvent before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be pretreated with a phosphoric acid cleaning solution and primed with Sherwin-Williams "Galvanized Iron Primer."
- D. Painting - After preparation as described above, each item shall be painted as follows, except color of paint for equipment and material located outside of the building or on the roof shall be as selected by the Architect.
 - 1. Painting is not required of equipment, equipment supports, and hangers with a factory-finish coat. Patch painting is required of any damaged areas to match factory-finish coat. Painting is required where equipment or equipment supports do

not have factory-finish paint. Equipment and associated hangers and supports shall be primed with one coat of alkyd, zinc potassium chromate metal primer, except insulated surfaces shall be primed with one coat Sherwin-Williams "Wall Primer and Sealer." Finish with two coats of Sherwin-Williams "Metalastic II-Steel Gray" Enamel. Exterior of belt guards and other protective guards shall be finished with two coats of machinery enamel in OSHA yellow color. Interior of items covered by belt guards and other protective guards shall be finished with two coats of machinery enamel in OSHA orange color. Nameplates on equipment shall not be painted.

2. Exposed pipes, conduits, and associated hangers exposed in equipment rooms and other unfinished areas such as storage areas shall have two finish coats of paint of the same color as adjacent walls or ceilings. Bare copper pipe shall not be painted. Canvas or paper jacket insulation of pipes exposed in unfinished areas shall be primed with Sherwin-Williams "Wall Primer and Sealer" before final two coats of paint. Hangers and supports in concealed areas not protected by factory-finish paint shall have one coat of Sherwin-Williams "Kromik Metal Primer."
3. All exposed gas piping and fittings, interior and exterior, shall be painted, coated or wrapped as described in Section 22 60 00 and this section as applicable.

E. Identification of pipes and equipment:

1. Equipment - Each piece of equipment shall be identified by stenciled marking that will read the same as the identification shown on plumbing drawings. Stencil letters shall be 2 inches high upper case painted with Sherwin-Williams "Metalastic II" white enamel.
2. Pipes and conduit - Color bands shall be painted on each pipe or conduit where exposed or accessible. Bands shall be 1-1/2 inches wide and shall be placed every 15 feet maximum along the pipe or conduit. Color bands shall be Sherwin-Williams "Kem Lustral" enamel as shown in the following color code schedule and chart. Provide color code chart, framed with glass front, sized appropriately for number of colors used. Post in mechanical room where directed by Engineer.
3. Color code schedule

COLOR BANDING CODE

Number	Color	Catalog Number
1.	Orange	No. F65 E 36
2.	Blue	No. F65 L 3
3.	Brown	No. F65 N 11
4.	Red	No. F65 R 1
5.	Black	No. F65 B 1
6.	Yellow	No. F65 Y 48
7.	Green	No. F65 G 40

4. Pipe shall be identified with flow arrows as described below

- a. Arrows shall be stencil type.
- b. Arrows shall be readable from floor.
- c. Arrows shall be installed every 15'-0" maximum.
- d. Arrows shall be painted on pipes.

F. Identification of Valves: Properly mark service and control valves. Valve markers shall be metal tags with designations stamped thereon or laminated engraved plastic chained with jack chains (not beaded chains) to their respective valves. Identification symbols or designations shall be the same as shown on the Contract Documents.

G. Equipment locations above acoustic tile ceilings: Provide colored brass push-pins complete with a minimum 1/2" shank and 5/8" diameter head. Pin head color shall be blue or color as selected by Architect or Owner. Locate push-pins directly below all scheduled plumbing equipment.

2.3 MOTORS, CONTROL, ELECTRICAL WIRING AND POWER REQUIREMENTS

A. Provide motors in accordance with NEMA Standards and suitably designed to match the starting and running characteristics of the driven equipment. Unless indicated otherwise, motors less than 1/2 horsepower shall be wound for 120 volt, single phase, 60 hertz. Motors 1/2 horsepower and above, unless indicated otherwise, shall be wound for three phase, 60 hertz, 200 volt, 208 volt, 230 volt, or 460 volt as required by the system voltage. Select motors coordinated with the utilization voltage and phase. Motors for equipment with VFD shall be matched to the VFD.

B. All starters and safety switches, except for those specified to be furnished with the plumbing equipment, shall be furnished as part of the Electrical Work - Division 26.

C. Starters and safety switches furnished with the plumbing equipment shall comply with the specifications of Division 26. Starters furnished as an integral part of the plumbing equipment shall be complete with properly sized overload heaters. Integral 3-phase motor starters and VFD's shall be provided with phase loss relay as specified in Division 26.

D. Domestic water temperature control wiring, equipment control wiring, and interlock wiring necessary for the proper sequence of operation of plumbing equipment shall be furnished as part of the Plumbing Work, Section 223300 - DOMESTIC WATER HEATERS and Section 221123 - PLUMBING PUMPS. Control wiring is any wiring, regardless of voltage, related to plumbing equipment that is not the equipment power circuit from the circuit breaker in the panelboard to the motor starter or safety disconnect switch and to the motor or equipment junction box. Where control devices (On-Off switch, Aquastat, etc.) that are intended to interrupt the motor or equipment power circuit are provided by the Plumbing Contractor and are mounted other than on or directly adjacent to the controlled equipment, the Plumbing Contractor shall provide wiring through these devices regardless of voltage or phases. All wiring shall conform to applicable sections of Divisions 26, 27, and 28 of the specifications. All low voltage control wiring in inaccessible areas or in exposed areas shall be in metal conduit and shall comply with the specifications of Divisions 26, 27, and 28. All low voltage control wiring in unexposed, accessible areas shall be wire in conduit

or U.L. approved plenum rated cable supported from the structure with ties spaced 3'-0" on center. All 120 volt wiring shall be wire in conduit and shall comply with the specifications of Divisions 26, 27, and 28 of the specifications.

- E. All equipment that has electrical connections shall have wiring terminals/connectors rated for not less than 75 deg. C. If terminals/connectors are provided that are rated for less than 75 deg. C., the mechanical contractor shall incur all costs associated with upsizing wire and conduit as required by the National Electrical Code.
- F. Voltage requirements for equipment that has electrical connections shall comply with the following voltage ranges as listed in ANSI C8.4.1, Voltage Tolerance Standard:
 - 480 Volt Equipment: Utilization Voltage Range = 504 Volts to 440 Volts.
 - 277 Volt Equipment: Utilization Voltage Range = 291 Volts to 254 Volts.
 - 208 Volt Equipment: Utilization Voltage Range = 281 Volts to 191 Volts.
 - 120 Volt Equipment: Utilization Voltage Range = 126 Volts to 110 Volts.
- G. Equipment that has voltage requirements which fall outside of the above values shall be provided with special power conditioning equipment as required to maintain the necessary voltage ranges to the equipment. Such conditioning equipment shall be provided by the equipment manufacturer as part of the equipment package at no additional cost to the owner.

2.4 FIRE-STOPPING

- A. Pipe penetrations of rated walls, floors, and floor-ceiling assemblies shall be constructed in accordance with Underwriter's Laboratories, Inc., Fire Resistance Directory, Volume II, Hourly Ratings for Through Firestop Penetrations. The Contractor shall provide U.L. firestop penetrations according to the particular wall, floor, or floor-ceiling assembly rating, construction type, pipe material, pipe size, insulation requirements, sleeve requirements, and the contractor's choice of firestop products as listed by U.L. Refer to the architectural drawings for the wall, floor, or floor-ceiling assembly construction types and ratings.

2.5 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall furnish and install all accessories, connections, bases, guards, supports, and incidental items necessary to fully complete the work, ready for use, occupancy, and operation by the Owner.
- B. Type Numbers Specified: MSS SP-58; for selection and application, MSS SP-69. Refer to Division 05, METALS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
 - 1. Concrete Insert: MSS SP-69, Type 18

2. Self-Drilling Expansion Shields and Machine Bolt Expansion Anchors: Fed. Spec. FF-S-325, permitted in concrete not less than four inches thick. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-235.
 3. Power-Driven Fasteners: Permitted in existing concrete or masonry not less than four inches thick when approved by the Architect/ Engineer for each job condition. Use fasteners capable of supporting a 1000 pound test load, with the actual load not exceeding 50 pounds.
- D. For Attachment to Steel Construction; MSS SP-69:
1. Welded Attachment: Type 22.
 2. Beam Clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used on steel beams only for individual copper tubing up to 7/8-inch outside diameter. Beam clamps on steel joists shall be concentric loading type. Beam clamps that are attached to only one side of a joist are NOT acceptable.
- E. Attachment to Metal Pan or Deck: As required for materials specified in Division 05 - METALS.
- F. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A 36 or A 575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turnbuckles shall provide 1-1/2 inches minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 1-1/2 inches by 1-1/2 inches, No. 12 gage, designed to accept special spring held, hardened steel nuts. Not permitted for condensate piping, fire and sprinkler piping or chemical waste drain piping.
1. Allowable Hanger Load: Manufacturers rating less 200 pounds.
 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 1/4-inch U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 2-inch galvanized steel bands, for insulated piping at each hanger.
- I. Pipe Hangers and Supports: Use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 00 - PLUMBING INSULATION, for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports. Provide Type 40 insulation shields at all other types of supports and hangers including those for pre-insulated piping.
1. General Types (MSS SP-69):
 - a. Standard Clevis Hanger: Type 1; provide locknut
 - b. Riser Clamps: Type 8 or 42
 - c. Wall Brackets: Types 31, 32, or 33
 - d. Saddle Support: Type 36, 37, or 38
 - e. Roller Support: Type 41, 43, or 46
 - f. Turnbuckle: Types 13 or 15

- g. U-Bolt Clamp: Type 24
- h. For Uninsulated Copper Tube: Material compatible for use with copper to prevent electrolysis
- i. Supports for Plastic Piping: As recommended by the pipe manufacturer

2. Plumbing Piping:

- a. Horizontal Piping: Types 1, 5, 7, 9, and 10
 - b. Chrome Plated Piping: Chrome plated supports
 - c. Hangers and Supports in Pipe Chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration, and compensate for all static and operational conditions
 - d. Blocking, Stays and Bracing: Angle iron or preformed metal channel shapes, 18 gage minimum
- J. Support hubless cast iron pipe and fittings per CISPI 301-12. Brace hubless cast iron pipe and fittings 5 inches and larger using Holdrite 117 Series No-Hub Pipe and Fitting Restraints or approved equal.
- K. Concrete Equipment Bases: Unless otherwise noted on the drawings or in the specifications, concrete pads and bases not less than 4 inches high and which project not less than 3 inches beyond the equipment on all sides shall be provided for pumps, compressors, water heaters, tank supports, and other similar floor-mounted equipment which normally requires foundations. Concrete shall conform to requirements in the concrete section of these specifications. The trade responsible for the supported equipment shall establish sizes and locations of the various concrete bases required and shall provide all necessary anchor bolts, together with templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with a suitable plate at bottom end of sleeve to hold the bolt. When indicated in the drawings or detailed specifications, other floor-mounted items of equipment shall have a similar concrete base. Special vibration isolation foundations that are required are specified in the detailed specifications.

2.6 PIPE SLEEVES

- A. Locate sleeves during normal course of work. Provide sleeves for piping and conduit passing through concrete floor slabs and concrete, masonry, tile, and gypsum wall construction. Sleeves shall not be provided for piping and conduit running embedded in concrete or slab on grade, except that copper piping shall require sleeves through slabs on grade. Sleeves through structural members shall be only as directed by Architect. In interior wall, provide 1/4 inch space all around between sleeve and conduit, piping, or insulation of piping.
- B. Sleeves placed in exterior walls below grade shall be O.Z. Gedney Type 'FSK', Thunderline 'LINK SEAL', Polywater PGKD Series or equal sleeve assemblies sized for the pipe or conduit encountered, except for cast iron piping. Sleeve assembly shall provide watertight seal and electrical insulation to reduce cathodic reaction. When a sleeve passes through a wall below a concrete slab on grade, the sealing assembly shall be on the outside of the wall. When a sleeve passes through a wall into a crawl space or

the building interior, the sealing assembly shall be in the crawl space or interior of the building. Provide sleeve assembly for copper piping through slab on grade, with sealing assembly located on interior side of floor slab. Where cast iron pipes pass through an exterior wall below grade, provide an iron-pipe sleeve two (2) pipe sizes greater than pipe passing through. Caulk between pipe and sleeve with a rubber-based compound.

- C. Where sleeves are located through fire-rated walls and floor/ceiling assemblies, provide sleeves and protect the penetration in accordance with Underwriter's Laboratories, Inc., Fire Resistance Directory, Volume II, Ratings for Through Firestop Penetrations.
- D. Sleeves in mechanical rooms with floor drains or hose bibbs shall extend 4 inches above floor. Provide flanges or flashing rings with sleeves in floors with waterproof membrane and clamp or flash into the membrane. Provide sleeves flush with floor in other rooms.
- E. Sleeves shall be constructed of 20 gage galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated.
- F. Fasten sleeves securely in floors or 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 from being forced into the space between pipe and sleeve during construction.
- G. All penetrations through exterior walls shall be sealed. Caulk above grade penetrations with a rubber-based compound.

2.7 WALL, FLOOR AND CEILING PLATES (ESCUTCHEONS)

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with setscrew for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes, and cover the entire pipe sleeve projection on all pipes including sanitary rough-ins.
- B. Thickness: Not less than 3/32-inch for floor plates. For wall and ceiling plates, not less than 0.025 for up to 3-inch pipe, 0.035 for larger pipe.
- C. Locations: Provide at all locations where pipe penetrates floors, walls and ceilings in exposed locations, except mechanical rooms.

2.8 ACCESS PANELS

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall provide access panels in all locations where required for access to concealed valves, traps, air cushions, controls, and any other equipment or materials requiring inspection or maintenance. Access panels shall be of adequate size and properly located so that concealed items will be readily accessible for servicing or for removing and replacing if necessary, except as indicated or specified otherwise. Access panels are not required in ceilings formed of removable acoustical panels.

- B. Access panels that are not fire-rated shall be Milcor or equal. Provide modular-sized access panels in inaccessible acoustic tile ceilings sized according to the tile size. Provide Milcor metal access panels with cam lock, continuous hinge and mounting trim to match finish encountered. Provide natural anodized aluminum finish for panels in kitchens and toilets. Provide prime finished steel for panels in other areas. Paint panels in finished areas to match finish surface.
- C. Where indicated and where access panels are installed in walls of shafts that are not sealed at each floor, access panels shall be Milcor or equal "Fire-Rated" and shall bear the Underwriters' Laboratories, Inc. Class B, 1-1/2 hour label. Openings shall be framed in accordance with the access panel manufacturer's recommendations. Frames shall be not lighter than 16-gage steel. Panels shall be not lighter than 20-gage steel and shall be insulated sandwich type. Panels shall have a continuous hinge, self-lubricating lock, a direct action-knurled knob, and an interior latch release mechanism.

2.9 CHARTS, DIAGRAMS, AND SCHEMES

- A. Charts, diagrams, and schemes listed below shall be provided under each applicable section of the detailed plumbing specifications by the Contractor, framed under glass, and installed where shown on the drawings or directed in the field. All charts, diagrams, and schemes shall be complete, neat, clear, legible, and permanent.
- B. Valve identification chart with typewritten schedule of all valves giving their tag number, description, location in building via room number, system served, and normal operation position.
- C. Piping schemes where required by the detailed specifications.

2.10 CATALOG DATA FOR OWNER

- A. Furnish one (1) bound copy or one (1) digital file (pdf format) of all Catalog Data on each manufactured item of equipment used in the mechanical work, complete with index listing the products alphabetically by name, together with the names and addresses of manufacturers, sales, and service representatives. Furnish two (2) bound copies or one (1) digital file (pdf format) of all Operating and Maintenance Instructions of each item of equipment. A single comprehensive file or digital file of all Catalog Data and Operating and Maintenance Instructions shall be submitted to the Engineer for review prior to transmittal to the Owner. Single sections or multiple files will not be reviewed.

2.11 RECORD OF AS-BUILTS AND CONDITIONS

- A. Provide a complete set of prints and electronic version of plumbing plans marked to indicate as-built conditions which are different from those shown on the original construction documents. Site as-built conditions which are different from the construction documents shall be dimensioned from building or identifiable marker. Accurate locations of all concealed utility lines, both interior and exterior shall be recorded. These drawings shall be delivered to the Architect/Engineer before being turned over to the Owner.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Coordination of Work:

1. The Contractor shall compare the plumbing drawings and specifications with the drawings and specifications of other trades, and shall report any discrepancies between them to the Architect/Engineer, and shall obtain from him written instructions for changes necessary in the plumbing work. The plumbing work shall be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor shall make proper provision to avoid interferences in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.
2. Anchor bolts, sleeves, inserts, and supports that may be required for the work shall be fully coordinated and compatible with the related equipment or materials. Locations shall be determined by the trade installing the related equipment or materials.
3. Slots, chases, openings, and recesses through floors, walls, ceilings, roofs, and partitions shall be located by the trades requiring them.
4. Locations of pipes, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The installing Contractors shall coordinate their work to the building structure and to other trades as directed by the General Contractor. No additional compensation or extension of completion time will be granted for extra work caused by a lack of coordination. The installing Contractor shall provide dimensions and locations of all openings, shafts, and similar items to the General Contractor for his coordination and execution. Work shall be installed as required so as not to interfere with or delay the building construction. Pipes, etc., shall be concealed above ceilings, in walls, or in floors as applicable in all areas of the building except in equipment rooms, unfinished storage rooms, or other areas specifically noted to the contrary.
 - a. Right-of-Way: Lines which pitch shall have right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
 - b. Offsets, transitions, and changes in direction of pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, drains, sanitary vents, etc., as required to affect these offsets, transitions, and changes in direction.
5. Exact locations of items such as hose bibbs, wall hydrants, fire department hose valves and other similar items in finished areas of the building and on the exterior of the building shall be coordinated with each other, the building structure, and architectural features thereof so as to be aligned with or centered on other items as applicable. Locations indicated on the drawings are approximate. Trades shall coordinate their work with door swings, block coursing, tile arrangement, required

clearances and other similar features before establishing the location of any components. Before any related work has begun, the Architect/Engineer may direct reasonable minor changes in equipment locations with no increase in contract price to the Owner. Before roughing in conduit or pipe, verify the location of equipment to be connected.

6. Installation and Arrangement: The Contractor shall install all plumbing work to permit removal of all parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, traps, motors, control components, and to clear the openings of swinging and overhead doors and of access panels.
7. Drawings by Contractor: When directed by the Architect/Engineer, the Contractor shall submit for review by Architect/Engineer drawings clearly showing certain portions of the plumbing work and its relation to the work of other trades before beginning shop fabrication or erection in the field.
8. Dimensions: The Contractor shall ensure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications. If he concludes that there is insufficient space for installation or specified materials, he shall immediately notify the Architect/Engineer of the conflict and shall stop affected work until he receives instructions as to how to proceed from the Architect/Engineer.
9. Damage to Work: The Contractor is responsible for damage caused by his work or workmen. Repairing of damaged work shall be done by the Contractor as directed by the Engineer at no additional cost.
10. Connections to Existing Facilities, Piping Systems, Etc: All connections to existing facilities, piping systems, etc., shall be made as required or deemed necessary to ensure the maintenance of continued operation of the above and provide the very minimum of interruption. This Contractor shall make such temporary connections as may be required to facilitate this work and to protect the existing building from damage. Any work which will in any way affect the continued operation of any existing facility shall be coordinated with the proper authorities as well as the Architect-Engineer before any service is interrupted.
11. The Contractor shall be responsible for any interruptions to existing services and shall repair any damages to existing systems caused by his operations.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items, in the opinion of the Architect/Engineer, shall be replaced.
2. All items subject to moisture damage (such as controls and electrical equipment) shall be stored in dry, heated spaces.
3. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical or mechanical injury. Clean plumbing equipment to remove dust, oil, dirt, plaster, mortar, trash, or

paint. Piping and conduit shall be blown out or flushed of all foreign matter before wires are pulled in or before connections are made to equipment or systems. Clean each boiler in accordance with manufacturer's instructions before connecting to the system.

- C. Protection of Electrical and I.T. Equipment: Plumbing and sprinkler piping and any other piping containing liquids shall NOT be installed directly over electrical panelboards, switchboards, I.T. equipment or motor control centers, unless the pipe is a minimum of 6 feet above the electrical equipment or above a structural ceiling (concrete cap or similar). If compliance with this requirement is not possible, notify the engineer immediately. If the piping is directly above and at least 6 feet above the electrical equipment, provide a galvanized steel drain pan installed directly under the piping. Drain pan shall have minimum 2 inch high sides with a drain pipe connection at the lowest point and shall be full width of the electrical equipment being protected. Extend drain pipe to exterior or to nearest floor drain.
- D. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.
- E. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

3.2 GENERAL PIPING INSTALLATION

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall furnish and install as shown on the drawings or as necessary to complete the working system in accordance with the intent of the drawings and specifications, a complete system of piping, valves, supports, anchors, sleeves, and all other appurtenances. The piping drawings are diagrammatic and indicate the general location and connections. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve the Contractor of responsibility for the proper erection of systems of piping in every respect suitable for the work intended as described in the specifications and as approved by the Architect/Engineer. Wherever two dissimilar metals join in any piping system, install a dielectric fitting at their intersection.
- B. Erection: Piping shall be properly supported and adequate provisions shall be made for expansion, contraction, slope, and anchorage without damage to joints or hangers. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe extending through the roof shall be properly flashed. All changes in direction shall be made with fittings. Wherever pipe hanger bears directly on the pipe being supported, the hanger shall be of the same material as the pipe.
- C. Arrangement: All piping shall be arranged so as not to interfere with removal of other equipment or devices nor to block access to doors, windows, manholes, or other access openings. Piping shall be arranged so as to facilitate removal of tube bundles. Flanges or

unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment. Piping shall be placed and installed so that there will be no interference with the installation of the equipment, ducts, etc. All piping shall be installed to ensure noiseless circulation. All piping shall be erected and pitched to ensure proper drainage. Piping shall be installed so as to avoid liquid or air pockets throughout the work. Pipe in finished areas shall be concealed. Install piping generally parallel to walls and column centerlines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surface. Pipe shall be installed to permit free expansion and contraction without damage to joints or hangers. Exposed piping shall be installed in practical alignment with the building. All valves and specialties shall be placed to permit easy operation and access, and all valves shall be regulated, packed, and glands adjusted at the completion of the work before final acceptance. Water pipes shall not be installed in attic spaces, crawl spaces, exterior walls or similar areas which are subject to freezing, unless indicated to be heat traced.

- D. Installation of Underground Pipe: Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swag or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall be kept free from water until pipe jointing material has set. Pipe shall not be laid when the condition of the trench or weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, or other substance will enter the pipe or fittings.

3.3 PIPE AND EQUIPMENT SUPPORTS

- A. Supports: The Contractor shall support plumb, rigid, and true to line all work and equipment furnished under each section of these specifications. The Contractor shall study thoroughly all general, structural, and plumbing drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted, or suspended, and shall provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support, whether or not shown on the drawings. When directed, the Contractor shall submit drawings showing supports for review by the Architect/Engineer.
- B. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Architect/Engineer.
- C. Use of chain, wire or strap hangers; wood for blocking stays or bracing; or hangers suspended from piping above will not be permitted. If products are rusty, replace or thoroughly clean and coat with prime paint.
- D. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 2-inch clearance

between pipe or pipe covering and adjacent work. Pipe hanger rods shall be attached to the top chord only on steel joists and beams by joist or beam clamps, without welding. Where clamps cannot be attached to the top chord of joists or beams, trapeze hangers shall be provided.

E. Horizontal Pipe Support Spacing:

1. Cast Iron: Five feet on centers maximum spacing. At least one hanger on each full length of pipe, close to hub where possible and at least one within 24 inches of each fitting, and wherever else required to prevent tendency toward deflection due to load. Provide a hanger at upper angle at each drop. Locate hangers adjacent to hubs on multiple fittings not more than four feet on centers.
2. Plastic and Glass Pipe: Support in accordance with manufacturer's recommendations.
3. For support spacing of all other horizontal piping, refer to MSS SP-69 and provide additional supports at valves, strainers, inline pumps and other heavy components. Provide a support within one foot of each elbow.

F. Vertical Pipe Supports--Cast Iron Stacks: Base of stacks shall be supported on concrete, brick in cement mortar, or metal brackets permanently attached to building structure. Support stacks on each building floor structure, but not to exceed 15 feet spacing.

G. Connections: All piping connecting to pumps and other equipment shall be installed without strain at the piping connection. The Contractor shall be required as directed to remove the bolts in flanged connections or to disconnect piping to demonstrate that piping has been so connected.

3.4 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-Connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.5 EXCAVATION AND TRENCHING

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings or as otherwise specified. No extras will be allowed for rock unless indicated otherwise. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on the drawings or as directed by the Architect/Engineer. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved method. Such sheeting and shoring shall be done as may be necessary for the protection of the work

and for the safety of personnel. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the Architect/Engineer, the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

- B. Trench Excavations (Includes under building and 5 feet outside of building): Trenches shall be of necessary width for the proper laying of the pipe or duct, and the banks shall be as nearly vertical as practicable. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum over depth of 4 inches below the trench depths indicated on the drawings or specified. Over-depths in the rock excavation and authorized over depths shall be backfilled with loose, granular, moist earth, thoroughly tamped. When corrosive material or unstable soil or material that is incapable of supporting the pipe is encountered in the bottom of the trench, the Contractor shall promptly notify the Architect/Engineer. Such unsuitable soil or material shall be removed to a depth as directed by Architect/Engineer and the trench backfilled to the proper grade with coarse sand, fine gravel, or other suitable backfill material, as directed by the Architect/Engineer.
- C. Sanitary Sewers and Water Mains: The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall be between 6 and 12 inches on either side of the pipe. The width of the trench above that level may be as wide as necessary for sheeting and bracing and the proper performance of the work. The bottom of the trench shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly on undisturbed soil for as much of the full length of the barrel as proper jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying by men skilled in this type of work.
- D. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.

3.6 BACKFILLING OF TRENCHES

- A. Trenches shall not be backfilled until all required pressure and other tests and inspections have been performed and until the utilities systems as installed conform to the requirements of the drawings and specifications. Trenches for piping shall be carefully backfilled with materials consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials saved from the excavation or borrowed as required. The backfill materials shall be granular in nature and shall not contain coal, dust, cinders, ashes, roots, sod, rubbish, corrosive materials, large clods of earth, or stones over 2-inch maximum dimension. The Architect/Engineer may reject any on-site or borrowed materials which he considers unsuitable for the intended use of the fill.

- B. Controlled compacted backfill shall be used under slabs-on-grade, building structure, concrete paving, asphaltic concrete paving, driveway, parking areas, and other areas so specified or indicated on the drawings. All backfill required to raise the surface to the desired subgrade shall be continuously controlled and placed in maximum of 8-inch loosely placed lifts and compacted to 100 percent maximum dry density beneath the building and 95 percent under all paved drives and parking areas in accordance with ASTM D 698 (Standard Proctor). The soils engineer shall check each lift and submit reports to the Architect/Engineer in accordance with Division 31 - Earthwork.
- C. Normal Backfill: Where controlled compacted backfill is not required, such as grassed areas, the trenches shall be carefully backfilled with material in eight-inch layers and thoroughly and carefully rammed until cover is not less than one foot. The remainder of the backfill material shall then be carefully placed in the trench in one-foot layers and tamped. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition as approved by the Architect/Engineer.
- D. Test for Displacement of Sewers: Sanitary sewer mains shall be checked by the Contractor to determine whether any displacement of the pipe has occurred after the trench has been backfilled to two feet or more above the pipe. A light shall be flashed between manhole locations and through each straight section of pipe. If the illuminated interior of the pipeline shows poor alignment, displaced pipe, or any other defects, in the opinion of the Architect/Engineer, such defects shall be remedied by the Contractor at his expense.
- E. Plants, turf, and surfacing that are to remain in the area of the excavation shall be carefully removed and placed where they will not be damaged. After the excavations are filled, the plants, turf, and surfacing shall be replaced as directed. Provide repairs for sidewalks, driveways, and other cement and asphalt surfaces which are damaged during excavating to match the adjacent work in material and finish.

3.7 CUTTING AND PATCHING

- A. The Contractor shall be responsible for all required digging, cutting, etc., incident to the work, and shall thereafter make all required repairs necessary to restore the cut structure or material to the condition existing prior to the cutting. In no case shall the Contractor cut into any major structural element, beam, or column without the written approval of the Architect/Engineer. All cutting, patching, repairing, or replacing of work required because of fault, error, tardiness, or damage by any trade shall be performed with no increase in the contract price to the Owner.

3.8 LUBRICATION

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall provide all oil and grease required for the operation of all equipment until acceptance by the Owner. The type and application of all lubricants shall conform to the recommendations of the manufacturer of the equipment involved. The Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the project. This Contractor shall be required to protect all bearings during installation and shall thoroughly grease or otherwise protect steel shafts

and other bare ferrous parts to prevent corrosion. All equipment shall be provided with covers as necessary for proper protection against damage or deterioration during construction.

3.9 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified under each applicable section of the detailed plumbing specifications, and submit the test reports and records to the Architect/Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.

3.10 QUIET OPERATION AND VIBRATION

- A. Systems shall operate under conditions of load without unusual or excessive noise or vibration. Unusual or excessive noise or vibration shall be corrected.

3.11 INSTRUCTIONS TO OWNER'S PERSONNEL

- A. Under each applicable section of the detailed plumbing specifications, the Contractor shall instruct the representative of the Owner in the proper operation and maintenance of all elements of the plumbing systems. A competent representative of the Contractor shall spend not less than two days in such formal instruction and shall spend such additional time as directed by the Architect/Engineer to fully prepare the Owner to operate and maintain the plumbing systems. The Contractor shall provide letter of instruction upon completion to the Architect/Engineer stating the date of instruction and the names of those in attendance.

3.12 GUARANTEE

- A. All plumbing equipment, materials, and labor required by the contract documents for this project shall be guaranteed to be free of defective materials or workmanship for a period of one year after final acceptance of the project. Defects in equipment, materials, or workmanship occurring during this period shall be corrected with new equipment and materials or additional labor at no cost to the Owner.

3.13 SITE VISIT REPORT

- A. Answer in writing each item of discrepancy noted on all site visit reports.

3.14 PHASING OF WORK

- A. The plumbing contractor is required to fully understand the phasing of work and to coordinate his work according to phasing plan drawings and related sections of the specifications.

END OF SECTION

SECTION 220700
PLUMBING INSULATION

PART 1 – GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section, and the Contractor is cautioned to read Section 22 00 00 carefully as items of work applicable to this section are included in Section 22 00 00.

1.2 DESCRIPTION OF WORK

- A. The work to be performed under this section of the specifications comprises the furnishing of all labor and materials and the completion of all work of this section as shown on the drawings and/or herein specified.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.
- C. In general, the work included under this section consists of, but is not limited to, the following:
 - 1. Field applied insulation for thermal efficiency and condensation control for plumbing piping and equipment.

1.3 RELATED WORK

- A. Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.
- B. Section 22 11 00, FACILITY WATER DISTRIBUTION.
- C. Section 22 13 00, DRAINAGE SYSTEMS.

1.4 SUBMITTALS

- A. In accordance with Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Manufacturer's Literature and Dimension Cuts:
 - a. Insulation Materials: Each type used. State surface burning characteristics and thermal properties.
 - b. Insulation Facings and Jackets: Each type used. State vapor barrier properties. State that white finish will be furnished for exposed pipe and equipment.
 - c. Insulation Accessory Materials: Each type used.

- d. Manufacturer's installation and fitting fabrication instructions for elastomeric unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

1.5 DEFINITIONS

- A. Cold: Equipment or piping handling media at design temperature of 60 Deg. F. or below.
- B. Hot: Equipment or piping handling media above 105 Deg. F.
- C. PCF: Density, pounds per cubic foot.
- D. Runout: Branch pipe connection up to one inch nominal size and not over 12 feet in length.
- E. Thermal Conductance: Heat flow rate through materials.
 - 1. Flat Surface: BTU per hour per square foot.
 - 2. Pipe or Cylinder: BTU per hour per linear foot.
- F. Thermal Conductivity (k): $(\text{BTU} \times \text{inch thickness}) / (\text{hour} \times \text{square foot} \times \text{degree Fahrenheit temperature difference})$.
- G. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.
- H. Unfinished Spaces: Spaces used for storage or work areas where appearance is not a factor, unexcavated spaces, crawl spaces, etc.
- I. Concealed Spaces: Spaces between a ceiling and floor construction above or between double walls or furred-in areas, pipe shafts, etc.
- J. Exposed: Open to view inside the building. For example, pipe run through a room, and not covered by other construction, is exposed.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Building characteristics of insulation materials shall comply with NFPA 90A, pertinent parts of which are noted as follows:
 - 1. Pipe insulation and coverings shall meet the requirements of NFPA 90A Sections 4-3.3.1 and 4-3.3.2 when installed in plenums or concealed spaces used as part of the air distribution system.
 - 2. In addition to NFPA, the insulation material shall not transform into a molten flaming liquid during combustion as characterized by some polyethylenes.

- B. Test Methods: ASTM E 84, UL 723, or NFPA 255.
- C. Insulation shall be Johns Manville, Owens Corning, Pittsburg Corning, or Armstrong. Trade names are used herein, unless indicated otherwise, to establish a standard of quality.
- D. Specified k factors are at 75 Deg. F. mean temperature unless stated otherwise. Where optional insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For a flat surface, thermal conductance equal thermal conductivity (k) divided by the thickness of the insulation. For runout insulation and condensation control insulation, no thickness adjustment need be made.
- E. All materials shall be compatible and suitable for service temperature and shall not contribute to corrosion or otherwise attack surfaces to which applied in either the wet or dry state.
- F. Underwriters' Laboratories, Inc. label or listing, or satisfactory certified test report from an approved testing laboratory will be required to show that surface burning characteristics for materials to be used do not exceed specified ratings.
- G. All sealants and adhesives must comply with all applicable South Coast Air Quality Management District (SCAQMD) VOC limits including but not limited to Rule #1168. All mastics and coatings must comply with all applicable Green Seal GS-11 VOC limits.

2.2 INSULATION FACINGS AND JACKETS

- A. Fed. Spec. HH-B-100 for Vapor Barrier Types I and II:
 - 1. Puncture Test Method: ASTM D 781.
 - 2. Type I, Low Vapor Transmission (0.02 Perm Rating), Beach Puncture 50 Units: For insulating facing on exposed equipment, and for all pipe insulation jackets. Facings and jackets shall be white all service type (ASJ) suitable for painting without priming.
 - 3. Type II, Medium Vapor Transmission, Beach Puncture 25 Units: Foil-Scrim-Kraft (FSK) type for concealed equipment.
 - 4. Factory composite materials may be used provided they have been tested and certified by the manufacturer to meet Beach puncture units specified above.
 - 5. Fire and smoke treatment of jackets and facings shall be permanent. The use of water soluble treatments is not acceptable.
 - 6. Pipe insulation jackets shall have 1-1/2 inch minimum lap at longitudinal joints and not less than 3-inch butt strips at end joints. Facing on board, blanket and block insulation shall have 2-inch laps or 3-inch minimum butt strips. Butt strip material shall be the same as the jacket or facing. Laps and butt strips may be self-sealing type with factory applied pressure sensitive adhesive.

2.3 MINERAL FIBER INSULATION

- A. Owens-Corning Fiberglass SSL II ASJ Heavy Density Sectional Pipe Insulation, Fed. Spec. HH-I-558, Form D, Type III (Molded), Class 12, $k = 0.24$.
- B. Molded pipe fitting covering: Fed. Spec. HH-I-558, Form E. Class 16, $k = 0.26$, for temperatures up to 370 Deg. F.
- C. Insulation thickness and type for various piping systems shall be as indicated in the following table (Pipe Size/Insulation Thickness).

PIPE SIZE/INSULATION THICKNESS(1)

System	Temp. Range (°F)	Runouts < 1"	1" to < 1-1/2"	1-1/2" to < 8"	8" & above	Ins. Type (4,5,6)
Domestic Hot Water & HWR (Copper)	90-140	1.0	1.0	1.5	1.5	A
	141-200	1.5	1.5	2.0	2.0	A
Tempered Water	85-109	1.0	1.0	1.0	1.0	A
Misc.	80-89	1.0	1.0	1.0	1.0	A
Domestic Cold Water (Copper)	56-79	1.0	1.0	1.0	1.0	A

NOTES:

- (1) Minimum thickness for insulation listed in preceding table is based on Thermal Conductivity, 'k' not exceeding 0.27 Btu per inch/hr. x sq. ft. x Deg. F. based on Mean Temperature of 75 Deg. F. Insulation with greater Thermal Conductivity shall have increased thickness to provide same performance characteristics as specified.
- (2) All horizontal sanitary piping above Kitchen or Dining Areas only.
- (3) All horizontal storm piping above lowest floor including roof drains from underside of deck to just below fitting at top of vertical portion of stack. Fittings at top and bottom of vertical sections of horizontal offsets shall be insulated. Lap joints, tape and seal.
- (4) A Fiberglass type insulation.

2.4 INSULATION ACCESSORY MATERIALS

A. Insulation inserts at pipe supports:

1. Material: Cellular glass or calcium silicate 1/2 section of insulation, same thickness as adjacent insulation.
2. Provide inserts for all insulated piping greater than 1-1/2 inch diameter. Install with metal insulation shields furnished with pipe supports, Section 22 00 00, PLUMBING GENERAL REQUIREMENTS. Minimum insert length: 10 inches for up to 3 inch pipe, 12 inches for 3 to 6 inch pipe, and 16 inches for 8 to 10 inch pipe.

B. Adhesives, Mastics, Cement:

1. Mil. Spec. MIL-A-3316B, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

2. Mil. Spec. MIL-A-3316B, Class 2: Adhesive for laps for adhering insulation to metal surfaces.
3. Mil. Spec. MIL-A-24179A, Type II, Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
4. Mil. Spec. MIL-B-19565B, Type 1 or Type II: Vapor barrier compound for indoor use.
5. Fed. Spec. SS-C-160A, Type IIIB, (ASTM C 449): Mineral fiber hydraulic-setting thermal insulating and finishing cement.
6. Other: Insulation manufacturer's published recommendations.

C. Mechanical Fasteners:

1. Pins, Anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
2. Staples: Outward clinching monel or stainless steel.
3. Wire: 18 gage soft annealed galvanized, or 14 gage copper clad steel or nickel copper alloy.
4. Bands: 3/4-inch nominal width, brass, aluminum or stainless steel.

D. Reinforcement and Finishes:

1. Glass Fabric, Open Weave: ASTM D 1668, Type III (resin treated) and Type 1 (asphalt treated).
2. Glass Fiber Fitting Tape: Mil. Spec. MIL-C-20070, Type II, Class 1.
3. Tape for Flexible Unicellular Insulation: Scotch No. 472, Nashua PE-12, or approved equal recommended by the insulation manufacturer.
4. PVC Fitting Cover: Fed. Spec. L-P-535D, Composition A, Type II, Grade GU, with Form B mineral fiber insert, for media temperature 45 Deg. F. to 250 Deg. F. Below 45 Deg. F. and above 250 Deg. F., provide double layer insert. Provide color matching, vapor barrier, pressure sensitive tape.

E. Firestopping Material: Refer to Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.

PART 3 – EXECUTION

3.1 GENERAL INSULATION REQUIREMENTS

- A. Required pressure tests of joints and connections shall be completed before application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale, and rust removed.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site.

No insulation material shall be installed that has become damaged in any way. The Contractor shall also use necessary means to protect his work and materials.

- C. Except for specific exceptions, insulate entire specified equipment and piping systems. Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings. Vapor barriers shall be continuous and uninterrupted throughout systems with operating temperature 60 Deg. F. and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports, and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of six inches.
- E. Insulation on hot piping and equipment shall be terminated square or beveled with insulating cement, covered with jacket, at items not to be insulated, access openings and nameplates.
- F. On cold systems, vapor barrier performance is extremely important. Particular care must be given to vapor sealing the fitting cover or finish to the insulation vapor barrier. All penetrations of the jacket and exposed ends of insulation must be sealed with vapor barrier mastic. All valve stems must be sealed with caulking which allows free movement of the stem but provides a seal against moisture incursion.
- G. Plumbing Work Not To Be Insulated:
 - 1. Piping and valves for fire protection system.
 - 2. Chromium plated brass piping.
 - 3. Domestic Hot Water: Unions, flexible connectors, control valves, expansion tank, pump.
- H. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastics and coatings at the manufacturer's recommended minimum coverage.
- I. New insulation (as specified herein) shall be provided and installed for existing piping at all locations where insulation has been removed during asbestos abatement and/or demolition of adjoining equipment. Contractor shall obtain and examine the asbestos abatement documents to determine the extent of the work.
- J. Where hot, cold and/or tempered water piping are bundled together, each pipe shall be insulated individually to prevent transfer of heat to other piping systems.
- K. All exposed insulation shall be provided with PVC jacket with no inserts to protect insulation against impact, UV exposure and water.

3.2 INSULATION INSTALLATION

A. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations with vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports.
2. Fittings, Flange and Valve Insulation:
 - a. Fiberglass Pipe insulation shall be installed with joints butted firmly together. Valves and devices requiring access shall be insulated with mitered sections of insulation equal in thermal resistance and thickness to the adjoining insulation. Fittings shall be covered with Schuller "Zeston" type, pre-molded PVC fitting covers. Jackets on pipe insulation shall be stapled using outward clinching type staples spaced 3" apart at least 1/4" from the lap edge on systems operating at 80 Deg. F. and above; below 80 Deg. F. the laps are to be vapor sealed using self-sealing lap, lap seal gun, or adhesive. All insulation elbows, fittings, flanges, joints, laps, voids, punctures, and end tapers shall be sealed with two coats of Foster Vapor Out 30-33 or Childers Chil Out CP-33 vapor barrier mastic and reinforcing mesh (total 35 mils or 0.9 mm dry film thickness) regardless of service and before Zeston covers are applied.
 - b. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least two inches.

B. Elastomeric Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions.
2. Pipe and Tubing Insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide inserts at supports as recommended by the insulation manufacturer. Insulation shields are provided under Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.
 - c. Elastomeric insulation shall be slipped on the pipe prior to connection wherever possible. Pipe leak tests shall be performed prior to the insulation of fittings. Where the slip-on technique is not possible longitudinal slit insulation shall be snapped on the pipe. All seams, voids, and butt joints shall be sealed with a vapor barrier adhesive or taped with 1-1/2 inch wide 3M #471 tape.
 - d. Fittings and valves shall be insulated with mitered sections of insulation. All joints shall be secured and sealed with vapor barrier adhesive. Approved factory-made fittings such as F & D Mfg. and Supply Co. may be used.

END OF SECTION

SECTION 220900
INSTRUMENTATION AND CONTROL FOR PLUMBING

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section and the Contractor is cautioned to read Section 22 00 00 carefully as items of work applicable to this section are included in Section 22 00 00.

1.2 DESCRIPTION OF WORK

- A. Furnish and install the system of automatic temperature controls (ATC) as shown on the contract drawings and hereinafter specified, for a complete and functioning system.
- B. Control sequences are specified in this section.
- C. Refer to Division 26 sections for the following work; not work of this section.
 - 1. Power supply wiring for power source to power connection on controls and/or unit control panels.
 - 2. Starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
- D. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
 - 1. Control wiring between field-installed controls, indicating devices, and unit control panels.
 - 2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of electric/electronic control equipment, of types and sizes required.
- B. Installer's Qualifications: Firms specializing and experienced in electric/electronic control system installations for not less than three (3) years.
- C. Codes and Standards:
 - 1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.
 - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.

1.4 RELATED WORK

- A. Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.
- B. Section 22 11 23, PLUMBING PUMPS

1.5 SUBMITTALS

- A. In accordance with Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials and including installation instructions and start-up instructions.
 - 2. Shop Drawings: Submit shop drawings for each control system, containing the following information:
 - a. Schematic flow diagram of system showing pumps, valves, and control devices.
 - b. Label each control device with setting or adjustable range of control.
 - c. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
 - d. Provide details of faces of control panels, including controls, instruments, and labeling.
 - e. Include verbal description of sequence of operation.
 - 3. Maintenance Data: Submit maintenance instructions and spare parts list. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements.

2.2 GENERAL

- A. Provide automatic temperature control products in sizes and capacities indicated, consisting of valves, sensors and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard control

system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide control systems with following functional and construction features as indicated.

2.3 CONTROL WIRING

- A. Provide control and interlock wiring, associated control system wiring, and pilot circuit wiring to accomplish any control sequence or function shown on the drawings, or plumbing systems and equipment specification.
- B. Associated control system wiring is defined as that wiring that powers or controls any control device provided for control of plumbing systems and equipment.
- C. Pilot circuit wiring is defined as that wiring that powers or controls any starter and other controller furnished as a component of plumbing systems and equipment and that is interposed in the power wiring; e.g., wiring from a safety device to the starter, and wiring from one starter to another for control interlocks.
- D. Power wiring is not included in this section.

2.4 THERMOSTAT

- A. Immersion aquastats in recirculating lines shall be Honeywell Type L4006A range 40-180 Deg. F., 5 degree differential. Complete with separable insertion well for pipe mounting, contacts shall be rated for 8 amps at 120 volts.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF AUTOMATIC TEMPERATURE CONTROL SYSTEMS

- A. General: Install systems and materials in accordance with manufacturer's instructions and roughing-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division 26 sections of these specifications.
- B. Electrical Work: All electrical work performed in the installation of the ATC system and the Energy Management System as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Conductors shall be protected by EMT conduit whenever those conductors are exposed, such as in mechanical rooms or risers, or where buried. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a minimum of 40 percent full. In no cases shall

conduit smaller than 1/2-inch size be allowed. Conductors rated for use in return air plenums shall be used.

3.3 SEQUENCE OF OPERATION

- A. Domestic Hot Water Control: Remote bulb electric aquastat in the storage tank, or as directed on the drawings, shall cycle its respective domestic hot water recirculating pump to maintain the recirculating water at a predetermined temperature.

3.4 ADJUSTING AND CLEANING

- A. Start-Up: Start-up, test, and adjust automatic temperature control systems. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- C. Calibration and Adjustments: After completion of the calibration, Contractor shall start up the system and perform all necessary testing and run diagnostic tests to ensure proper operation. An acceptance test in the presence of the Owner's representative or engineer shall be performed prior to substantial completion of project.

3.5 CLOSEOUT PROCEDURES

- A. Owner's Instructions: The ATC Contractor shall provide three copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control system supplied. This Contractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period. The duration of the instruction period shall be no less than 2 hours, during normal working hours. Schedule instruction with Owner, provide at least 7-day notice to Contractor and Engineer of training date.
- B. Warranty and Service: All ATC devices shall be warranted to be free from defects in workmanship and material for a period of one year from the date of substantial completion of the project. Any equipment found to be defective during this period shall be repaired or replaced without expense to the Owner. Factory-authorized warranty service shall be available.

END OF SECTION

SECTION 221100
FACILITY WATER DISTRIBUTION

PART 1 – GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 220000, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section and the Contractor is cautioned to read Section 220000 carefully as items of work applicable to this section are included in Section 220000.

1.2 DESCRIPTION OF WORK

- A. The work includes providing a complete plumbing system including, but not necessarily restricted to, the following:
 - 1. Domestic water system to a point five feet away from exterior building walls.
 - 2. Installation and connections to miscellaneous equipment furnished by Owner.
 - 3. Connections to fixtures and equipment provided under other sections of these specification.
 - 4. Miscellaneous work as described herein, as shown on drawings, and as required for a complete system.

1.3 RELATED WORK

- A. Section 220000, PLUMBING GENERAL REQUIREMENTS.
- B. Pipe Insulation: Section 220700, INSULATION
- C. Water Heaters: Section 223300, DOMESTIC WATER HEATERS
- D. Plumbing Fixtures: Section 224000, PLUMBING FIXTURES
- E. Pumps: Section 221123, PLUMBING PUMPS

1.4 SUBMITTALS

- A. Manufacturer's shop drawings shall indicate that piping and equipment meet specified codes. All piping, pump systems, equipment, and fittings that are connected to potable water systems, shall meet the 1996 Safe Water Drinking Act and the 2011 Reduction of Lead in Drinking Water Act, and where applicable, meeting NSF Standard 61, and be so labeled and be so certified. In accordance with Section 220000, PLUMBING GENERAL REQUIREMENTS, furnish the following:

1. Manufacturer's Literature and Data:
 - a. Piping
 - b. Valves
 - c. Backflow Preventers
 - d. Strainers
 - e. Shock Absorbers
 - f. Circuit Setters
 - g. Thermometers
 - h. Pressure Gages
 - i. Access Panels
 - j. Hydrants
 - k. Tempering Valves
 - l. Pipe Supports (except hangers)

PART 2 – PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL CEILING PLATES

- A. Provide in accordance with specifications in Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.

2.2 WATER SERVICE CONNECTIONS TO BUILDING

- A. All interior and exterior copper tubing shall be Certified Tube (NOT Standard Tube or Streamline Tube) meeting all chemical, mechanical AND dimensional requirements of the applicable ASTM standards.
- B. From inside face of exterior wall to a distance of approximately five feet outside of building and underground inside building, material shall be as follows:
 1. Less Than 3 Inch Size: ASTM B 88, type K, seamless, annealed. Copper tubing shall meet ALL ASTM requirements including but not limited to chemical, mechanical and dimensional requirements. Fittings as specified for Interior Domestic Water Piping using brazed joints with brazing alloys (AWS A5.8).

2.3 INTERIOR DOMESTIC WATER PIPING (DISTRIBUTION)

- A. Copper Tube and Fittings: All interior and exterior copper tubing shall be Certified Tube (NOT Standard Tube or Streamline Tube) meeting all chemical, mechanical AND dimensional requirements of the applicable ASTM standards.
 1. Tube: ASTM B 88:
 - a. Above ground: Type L, hard drawn.
 2. Fittings: Wrought copper, ASME B16.22 or cast copper alloy ASME B16.18. Victaulic or accepted equal full flow copper fittings with grooved ends. Grooved

copper fittings shall be copper per ASTM B75 alloy C12200; bronze sand cast per ASTM B-584 copper alloy CDA 844 (81-3-7-9) per ANSI B16.18.

3. Joints:

- a. Above ground: Soldered in accordance with ASTM B828, ASTM B32 lead free solder, ASTM B813 lead free flux. Lead free shall mean less than 0.2 percent lead. Grooved end copper piping systems as manufactured by Victaulic Company of America or accepted equal may be installed 2" – 8". For grooved end systems, couplings shall be copper tubing sized manufactured to ASTM A536 ductile iron Grade 65-45-12 painted copper color alkyd enamel. Gaskets for grooved system shall be of flush seal pressure responsive design having properties as designated in ASTM D2000. Installation-Ready, for direct slab installation without field disassembly. Victaulic Style 607H or equal.
- b. Gaskets shall be UL classified in accordance with ANSI/NSF-61 for Potable water service.

B. Brass, Copper, Chromium-plated nipples - ASTM B687.

C. Press Fittings: Copper press fittings by Viega, Ridgid Tool Company or accepted equal, requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

D. Push-to-Connect Fittings: Copper push-to-connect fittings by Sharkbite, Victaulic Company, "Permalynx", Mueller "ProLine", meeting requirements of ASME B16.18 or ASME B16.22, with stainless steel internal components and EPDM seals.

E. Above Ground Water Piping: CPVC (Chlorinated Polyvinyl Chloride) pipe and fittings shall be CPVC compound with a cell class of 24448 for pipe and 23447 for fittings as per ASTM D-1784 and conform with NSF Standards 14 and 61. Piping 2" and smaller shall be CPVC copper tube size manufactured to standard dimension ratio (SDR) 11 and shall conform to ASTM D-2846. Transition fittings shall have brass male or female connections with integral CPVC socket connections. CPVC shall not be used in return air plenums, and shall not pass through fire-rated walls or floors. Pipe and fittings shall be Flowguard Gold or equal.

2.4 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, including those furnished by the Owner or specified in other sections.

1. Pipe: Red brass, standard weight, chrome plated.
2. Fittings: Screwed brass or bronze, Class A, 125 pound, drainage pattern for waste.
3. Nipples: Brass, standard weight.
4. Unions: Brass or bronze. Unions 2-1/2 inches and larger shall be flange type with approved gaskets.

B. Unfinished and Mechanical Rooms: Chrome-plated brass piping is not required. Paint as specified in Section 22 00 00 PLUMBING GENERAL REQUIREMENTS.

2.5 VALVES

- A. General: All valves and specialties shall be suitable for 125 psi working pressure except as otherwise indicated. Each item shall have threaded, flanged, press or sweat connections as applicable to match joints specified for its respective service. All valves on domestic water piping shall be installed BELOW ductwork and other piping for ease of access.
- B. Valves:
 - 1. Hot and Cold Domestic Water Service Acceptable manufacturers subject to compliance with requirements are Nibco, Apollo, Jenkins, Hammond, Milwaukee, Lunkenheimer, Watts and Victaulic.
 - a. Gate valves (Rising Stem): Valves 2 1/2 inch and smaller shall be Class 125 rising stem, union bonnet, solid wedge and manufactured in accordance with MSS-SP-139. Body, bonnet and wedge shall be of bronze ASTM B-62. Stems shall be of dezincification-resistant silicon bronze ASTM B-371 or low-zinc alloy B-99, non-asbestos packing and malleable or ductile iron handwheel. Where higher operating pressures approach 150 psi, Class 150 union bonnet valves of like construction shall be used. Valve ends shall be threaded or solder-type. [Class 125 NIBCO T124 (threaded); Class 150 NIBCO T134 (threaded), S134 (solder)]
 - b. Ball valves: Valves 2 1/2 inch and smaller shall be rated 150 psi SWP and 600 psi non-shock WOG and shall have 2 piece cast bronze bodies, TFE seats, full port, separate packnut with adjustable stem packing, anti-blowout stems and chrome-plated brass/bronze ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110. [NIBCO T585-80-LF (threaded); S585-80-LF (solder)].
Note: Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included. [NIBCO T585/70NS (threaded); S585-0NS (solder)]
 - c. Globe valves: Valves 2 1/2 inch and smaller shall be Class 125 and manufactured in accordance with MSS-SP80, body and bonnet shall to be of bronze ASTM B-62. Stems shall be of dezincification-resistant silicon bronze ASTM B-371 or low-zinc alloy B-99, non-asbestos packing, TFE seat disc and malleable or ductile iron handwheel. Where higher operating pressures approach 150 psi, Class 150 union bonnet valves of the like construction shall be used. Valve ends shall be threaded or solder-type. [Class 125 NIBCO globe T211-Y (threaded); S211-Y (solder); Class 150 NIBCO globe T235-Y (threaded); S235-Y (solder)]
 - d. Check valves:
 - (1) Valves 2 inch and smaller shall be Y-pattern swing-type manufactured in accordance with MSS-SP-139, Class 125, bronze ASTM B-62 body

with TFE seat disc. Where higher operating pressures approach 150 psi, Class 150 valves of like construction shall be used. Valve ends shall be threaded or solder-type. [Class 125 NIBCO T413-Y (threaded); S413-Y (solder); Class 150 NIBCO T433-Y (threaded); S433-Y (solder)]

- (2) Valves 2-1/2 inch and larger shall be swing-type manufactured in accordance with MSS-SP71, Class 125 flanged ASTM A126 Class B cast iron body with bronze trim, non-asbestos gasket, or wafer style with stainless steel spring, bronze disc plates, rubber seat, body of cast iron ASTM A126 Class B or A48 for use with Class 125/150 flanges. Spring-actuated valve shall be used on pump discharge. Swing check with outside lever and spring shall be used on sump, sewage and storm drain lines. (Swing-type NIBCO F918-B; Spring-actuated wafer-type NIBCO W920W or KW900W or W910W; Swing-type with outside lever and spring NIBCO F918-BL&S)

- C. Hose bibbs: Jay R. Smith "Quarterhorse" – 1/4 Turn Wall Hydrant With Warm Climate Hydrant, integral vacuum breaker and lockable stainless steel box with concealed hose connection.
- D. Wall hydrants: Watts HY-420, Josam Series 71350 lead free, Prier C-534, Zurn Z1310, Smith 5619, or equal, cast bronze, non-freeze type with satin Nikaloy exterior face, integral vacuum breaker, renewable seat, loose key, for servicing from outside. Mount 18" above finished grade.
- E. Water Hammer Arrestors: Mifab WHB Series, Josam "Absorbotron" 75000 Series, Smith 5000 Series "Hydrotrols", Zurn Z1700 "Shoktrols", Wade "Shokstop" or equal, bellows type, lead-free, stainless steel. (SA-A Max. 11 SFU; SA-B Max. 32 SFU; SA-C Max. 60 SFU). Provide on both hot and cold water branches at end of lines serving all water closets, urinals, lavatories, sinks, showers, laundries, wall hydrants and where shown on drawings. Job fabricated air chambers will not be permitted. O-ring type shock absorbers will not be accepted. (ASME/ANSI A112.26.1 OR ASSE 1010)
- F. Tempering Valve (Leonard or Equal):
 1. Provide Model 210 thermostatic mixing valve with locked screw driver temperature adjustment with dial plate, Dura-Trol solid bi-metal thermostat, adjustable high temperature limit stop set for 120 Deg. F. brass, bronze, stainless steel and nylon construction. (ASSE 1016, Single Application) (ASSE 1017 Multi Application)
 - a. TV-1: Leonard TM-26-LF 3/4 inch thermostatic mixing valve, maximum 26.0 GPM, minimum 1GPM domestic hot water with straight checkstops and IPS connections.

2. Individual Fixture Tempering Valves:

- a. Provide Watts Model Series LFUSG-B-M2, or equal, under-sink Guardian ASSE 1070 thermostatic tempering valve for single lavatory and hand sink applications. Provide at all lavatory and hand sink locations including kitchen hand sinks applications (not including dorm room lavatories or sinks). Set valve for minimum 105 Deg. F, maximum 109 Deg. F.
 - b. Provide Watts Model Series LFMMV, Bradley S59-4000A, Powers LFG480, or equal, thermostatic mixing valve ASSE 1070 for multiple lavatory and hand sink applications. Provide at all lavatory and hand sink locations including kitchen hand sinks applications (not including dorm room lavatories or sinks). Set valve for minimum 105 Deg. F., maximum 109 Deg. F.
- G. Balancing valves shall be circuit setters as manufactured by Bell and Gossett, Watts, Tour Andersson, Victaulic or equal, and shall be a balancing valve of lead free all bronze construction, suitable for use in potable water systems. Valve shall have pressure taps with built-in check valves to determine pressure drop across valve. The pressure drop and the setting of the valve shall determine the actual system flow rate requirement. Valve shall be furnished with adjustable memory stop or locking device so the valve can be closed without disturbing the setting and be returned to the balanced position without further adjustment, and preformed polyurethane insulation suitable for use on domestic hot water and cold water systems. Unit to be suitable for minimum 175 psi working pressure at minimum 230 Deg. F. operating temperature. Tour Andersson Circuit Balancing valves containing digital readout handwheel for balancing hidden memory feature with locking tamper-proof setting and EPDM o-ring seals may be used. 1/2" – 2" shall be 300 PSI. A metal brass copper alloy body. 2-1/2" and larger shall be 300 psi grooved end.
- H. Flow Splitter Valves: Kemper Water Control Systems, Inc. No. 6510601500, or equal dynamic self-regulating and self-cleaning flow regulator device, NFP/ANSI 61 and NSF/ANSI 372 certified, 1/2 inch FPT connections, lead free corrosion resistant de-zincified red brass body, dual tees, 1/4 turn shutoff valves, flow direction indicator, factory insulation jacket.

2.6 BACKFLOW PREVENTERS

- A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be same size as line in which installed. Device shall be certified by recognized testing laboratory listed. Provide air gaps with drain pipe if piped to floor drain the same size as vent discharge on all backflow preventers with atmospheric vent. Extend drain to nearest floor drain with air gap. Listed below is a list of connection to the potable water system which shall be protected against backflow or back siphonage:
1. Reduced Pressure Backflow Preventer (ASSE 1013; AWWA C511; CSA CAN/CSA-B64.4): Watts Series LF909, Series LF009 or equal, lead free, complete with strainer, test cocks, and valves. Install top of backflow preventer 4'-0" above floor.
 - a. Water service entrances

2. Hose Vacuum Breaker Type (ASSE 1011; CSA CAN/CSA-B64.2):
 - a. Watts No. NF8C or equal, with non-removable and manual drain feature for freezing conditions. New wall hydrant (if not provided as an integral part of the Hydrant)
 - b. Watts No. LF8A, LF8AC (chrome finished), Cash Acme VB-222, Zurn BFP-9, or Legend T-553CNL, lead free, with non-removable feature. Hose bibbs and sinks with threaded outlets
3. Pressure Vacuum Breaker for Continuous Pressure Systems (ANSI/ASSE 1020, CSA B64.1.2):
 - a. Watts 008PC-QT, Zurn 460XL, or Conbraco 4A-900-SVB (spill resistant)
 - (1) Automatic clothes washer (if washer unit is labeled as conforming to ASSE 1007, pressure vacuum breaker is not required.)

2.7 STRAINERS

- A. Install on inlet of reduced pressure zone and double check backflow preventers, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage, and where shown on drawings. Strainer element shall be removable without disconnecting piping. Suitable for 125 psi working pressure. Watts, Mueller Steam Specialty, or equal with bronze or stainless steel screen with valved and capped blow-off outlet.
 1. Body: 3 inch or smaller, brass or bronze; 4 inch and larger, cast iron with FDA approved epoxy coating suitable for potable water.

2.8 PRESSURE GAGES FOR WATER

- A. Gages for water pressure shall be Weksler Type BA14, 4-1/2 inch diameter dial, 1/4" NPT connection size, all metal aluminum case, bottom connected. Dials shall be black on white background throughout, 2 psi graduation, 20 psi figure graduation, brass bourdon tube and socket. Range shall be 0 to 160 psig. Provide tee handle cock and brass pressure snubber for water service.

2.9 THERMOMETERS

- A. Thermometers for water temperature shall be Weksler Type AS5H-9-AL or equal, adjustable angle form, blue spirit mercury-free column approximately 9 inches long, 30 to 240 Deg. F. range, 2 degree increments and complete with brass well.

2.10 AUTOMATIC AIR VENTS

- A. Automatic Air Vent (Risers): Caleffi "Plumbvent" Model NA502640A for highest points in water system. Lead free DZR brass body. Max working pressure 150 PSI.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

1. Suspended horizontal piping shall be supported by adjustable wrought steel clevis hangers. Where supports bear on copper pipe, they shall be copper plated. Chain, strap, wire or other make-shift devices will not be permitted as hangers or supports. Hangers on all insulated pipes shall go around the insulation, with galvanized sheet steel saddle of sufficient size and thickness to prevent crushing of the insulation. Risers shall be securely supported and braced in an approved manner. Hangers for metal piping shall be spaced not over 6 feet apart for pipe 1/2 inch or smaller, 8 feet apart for 3/4 inch pipes and not over 10 feet apart for pipes 1 inch or larger. Hangers shall be located at all changes in direction. Maximum pipe support spacing shall be in accordance with Table 1 – MAXIMUM PIPING SUPPORT SPACING, except where grooved couplings are used, no pipe length shall be left unsupported between any two grooved couplings:

Table 1 - Maximum Piping Support Spacing

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
ABS Pipe	4	10 ^c
Aluminum Pipe and Tubing	10	15
Brass Pipe	10	10
Brass Tubing, 1¼-inch Diameter & Smaller	6	10
Brass Tubing, 1½-inch Diameter & Larger	10	10
Cast-Iron Pipe ^b	5	15
Copper or Copper-Alloy Pipe	12	10
Copper or Copper-Alloy Tubing, 1¼-inch Diameter and Smaller	6	10
Copper or Copper-Alloy Tubing, 1½-inch Diameter & Larger	10	10
CPVC Pipe or Tubing, 1-inch & Smaller	3	10 ^c
CPVC Pipe or Tubing, 1¼-inch & Larger	4	10 ^c
Lead Pipe	Continuous	4
PB Pipe or Tubing	2-2/3 (32 inches)	4
Polypropylene (PP) Pipe or Tubing, 1-inch or Smaller	2-2/3 (32 inches)	10 ^c
Polypropylene (PP) Pipe or Tubing, 1¼-inch or Larger	4	10 ^c
PVC Pipe	4	10 ^c
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm		
a. See Section 301.18.		
b. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.		
c. Mid-story guide.		

2. Install branch piping for water from the respective piping systems and connect to all fixtures, valves, outlets, and equipment, including those furnished by the Owner or

specified in other sections of these specifications. Approximate locations for roughing-in are shown on the contract drawings. No piping or roughing-in shall be started until data showing exact locations for equipment and connections required are provided by the Architect. This data shall then be used for roughing-in equipment. Individual stops and other connection components not furnished with the equipment, but required for a complete installation, shall be provided under this section of these specifications. All exposed trim and fixture supply pipe, including but not limited to lavatory and water closet rough-in piping, except in laundry, shall be chrome-plated.

3. Install trim and fittings provided with casework, cabinets, and laboratories, but not installed at point of fabrication.
4. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.
5. All pipe runs shall be laid out and scheduled to avoid interferences with other work.
6. Press connections: Copper press fittings shall be made in accordance with the manufacturers installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
7. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Isolation gate valves shall be installed on each side of each major piece of equipment and at other points indicated or required for draining, isolation, or sectionalizing purposes. Discharge of relief valves and backflow preventers shall be piped full size of valve connection to 6 inches above nearest floor drain or to exterior concrete pad as marked on drawings. Pipe shall be supported so that weight of pipe is not on valve body. Trap primers shall be piped full size to the floor drain indicated.
8. Exterior cold water main shall have a minimum of 36-inch cover unless indicated otherwise on drawings.
9. Unions or flanged joints shall be provided on each side of each valve 2-1/2 inch or larger and in each line immediately preceding the connection of each major piece of equipment. Unions shall be 125 psi bronze seat type. Flanges shall be ANSI standard 125 psi service with 1/16 inch thick composition or red rubber gaskets. Where grooved end piping and butterfly valves are used, Victaulic Style 608 valves with 607H couplings will be considered unions.
10. Joints between pipes of dissimilar metals shall have dielectric fittings such as unions, flanges or Clearflow dielectric nipples to isolate metals. Isolation shall be accomplished by non-metallic sleeves or couplings of materials suitable to withstand temperatures and pressures encountered.
11. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation.

A distributor's representative is not considered qualified to conduct the training or jobsite visits.

12. Anchors for pipe shall be provided at all flush valves and fixtures or where required to localize pipe movement. Anchors shall consist of brass collars bolted to the pipe and rigidly connected to the building structure in an approved manner and so as not to damage the building structure.
13. Provide manufacturer's certification of all Pro-Press piping installations for full manufacturer's warranty.

B. Domestic water piping shall conform to the following:

1. Grade all lines to facilitate drainage. Provide hosed-end drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.
3. Provide drain lines from reduced pressure backflow preventers to nearest floor drain or to exterior concrete pad.
4. Install domestic hot water piping such that non-circulated portions of piping to public lavatories are less than 24 inches total length.

3.2 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Refer to Specification Section 220000, Paragraph 3.01.C.1 for requirements for piping above electrical equipment.

3.3 PROTECTION OF PLASTIC PIPE

- A. All plastic piping shall be installed with sufficient distance and insulation relative to recessed light fixtures in accordance with Plastics Pipe Institute (PPI) Technical Note 56 "Installation of Plastic Pressure Piping Materials Near IC-Rated and Non-IC-Rated Recessed Lighting Fixtures".

3.4 TESTS

- A. General: Contractor shall provide all instruments, materials, and labor required. Tests shall be made in the presence of the Owner or Authority having jurisdiction or as otherwise directed by the Architect, who shall be given five (5) days notice by this Contractor of his readiness to perform such tests. Any leaks that develop during the tests shall be repaired by remaking the joint or replacing pipe and fittings. Temporary caulking will not be permitted. No piping shall be insulated or concealed until it has been tested, with results acceptable to the Architect. Air testing will be acceptable where permitted by the Virginia Uniform Statewide Building Code. Do NOT perform air testing on systems where plastic piping, including CPVC and PEX piping, are installed. Test systems either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 125 psig or at 50

percent higher than actual operating pressure which ever is greater for one hour during inspection and prove tight without any loss of pressure.

- C. Optional tests for connections to existing systems: After installation of piping and connecting to existing systems, and where herein before specified tests are impractical, test all new piping under actual operating conditions and prove tight to the satisfaction of the Architect.
- D. Reduced pressure principle backflow preventers, double check-valve, assemblies, and pressure vacuum breaker assemblies shall be tested to determine whether they are operable. The testing procedure shall be in accordance with one of the following:
 - 1. Reduced Pressure Principle: ASSE 5010-1013-1-91 with August 1992 Revisions.
 - 2. Double Check-Valve: ASSE 5010-1015-1-91 with August 1992 Revisions; ASSE 5010-1015-2-91 with August 1992 Revisions; ASSE 5010-1015-3-91 with August 1992 Revisions; ASSE 5010-1015-4-91 with August 1992 Revisions.
 - 3. Pressure Vacuum Breaker: ASSE 5010-1020-1-91.

3.5 DISINFECTION (COPPER SYSTEMS)

- A. After tests have been successfully completed, thoroughly flush and disinfect the interior domestic water distribution system in accordance with the local Health Department. In the absence of a prescribed procedure, systems shall be disinfected in accordance with AWWA C651 or AWWA C652 and Section 610 of the 2021 Virginia Plumbing Code.
- B. Optimal Disinfection: After all tests have been satisfactorily completed, the entire water distribution system shall be thoroughly flushed and disinfected. Disinfect by tapping the main and introducing a solution of chlorine and water in such quantity as to provide a concentration of not less than 50 PPM with all water lines filled with water from the water main connection to all supply outlets. Care shall be taken not to flush the lines at this time. Air only shall be allowed to escape. This solution shall be allowed to stand in the lines for not less than twenty-four hours, after which the lines shall be flushed out until a residual reading of 0.5 PPM is obtained. After disinfection is complete, a bacteriological test shall be performed on the system. If contamination is still present, repeat the disinfection procedure until no contamination is present.

3.6 CLEANING

- A. Remove trash, plaster, dust, paint spots and all foreign matter from outside of all piping and equipment.
- B. The Contractor shall check each length of pipe before it is put in place to make certain there is not foreign material (stones, sand, etc.) in the systems. Provide temporary bypass around equipment if or as required. All plumbing pipes shall be thoroughly flushed with water to remove construction debris before final connections are made to equipment and fixtures.

3.7 REPORTS

- A. Reports of cleaning, disinfection and testing: Contractor shall verify ***in writing before completion of the job*** that all specified cleaning procedures, tests, and disinfection have been performed, with results as specified or as required by codes.

END OF SECTION

SECTION 221123
PLUMBING PUMPS

PART 1 – GENERAL

1.1 CONDITIONS

- A. The applicable provisions of SECTION 220000, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section, and the Contractor is cautioned to read Section 220000 carefully as items of work applicable to this section are included in Section 220000.

1.2 DESCRIPTION OF WORK

- A. Domestic hot water circulating pumps
- B. Sump pump

1.3 RELATED WORK

- A. SECTION 220000 - PLUMBING GENERAL REQUIREMENTS.
- B. SECTION 220900 – INSTRUMENTATION AND CONTROL FOR PLUMBING.

1.4 SUBMITTALS

- A. In accordance with SECTION 220000 - PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Domestic hot water circulating pump
 - b. Sump pump

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers (Subject to compliance with requirements):
 - 1. Goulds
 - 2. Taco
 - 3. Armstrong
 - 4. Bell & Gossett
 - 5. Wilo
 - 6. Zoeller (Pedestal & Submersible)
 - 7. Pentair Myers (Pedestal & Submersible)

8. Grundfos
9. Federal (Pedestal)
10. Paco
11. Aurora Pump Co.
12. Liberty Pumps
13. TechFlo, a division of TLA, Inc.
14. ITT R&CW
15. Hy Fab, a division of JMP, Inc.
16. VC Systems
17. Quantumflo

2.2 DOMESTIC HOT WATER CIRCULATING PUMP

A. Domestic hot water circulating pumps:

1. Pump shall be equal to B&G Booster series, all bronze, line-mounted unit suitable for pumping water at 210 Deg. F.
2. Pumps shall be of the horizontal, oil-lubricated type, specifically designed for quiet operation, suitable for 125 lb. working pressure.
3. Pumps shall have a ground and polished steel shaft with a hardened integral thrust collar and shall be supported by two horizontal sleeve bearings designed to circulate oil. Pumps shall be equipped with a mechanical seal with carbon seal face rotating against a ceramic seat.
4. Motor shall be of the open, drip-proof, sleeve-bearing, quiet-operating, rubber-mounted construction. Motors shall have built-in thermal overload protectors.
5. HWCP-1 shall be Bell & Gossett Model PD35S, or approved equal with a capacity of 5.4 GPM at 11.75 Ft. head when directly driven through a self-aligning flexible coupling by an oil-lubricated 1/2 HP motor, 120 Volts, 60 Cycle, single Phase.
6. Submit for review the manufacturer's certified characteristic performance curve for the impeller size to be furnished. The operating point on the characteristic performance curve for the impeller size to be furnished shall be to the left (shut-off side) of and not more than 5 percent below the point of maximum efficiency for the impeller to be furnished.
7. Pump motor shall be non-overloading at any point on the head-capacity curve.
8. Provide suitable disconnect switch, type as required by NEC and local code.
9. Provide immersion aquastat for each pump, connected to energized pump when return water temperature drops below its setting.
10. Pump shall be constantly energized, only shutting down by aquastat when circulating loop temperature is satisfied. Do not install time clock on this system.

B. Vibration Isolation: Inline pumps shall be supported on Type SPNM spring isolators under supports. Use elbow-type neoprene flexible pipe couplings on each side of pump. The vertical load is to be carried by the supports, not by the flexible couplings.

2.3 SUMP PUMP (ELEVATOR SHAFT)

- A. Sump pump shall be Stancor "Oil-Minder", Ebara "Oil Smart", Xylem B&G Model ELKT2EC0511 or equal, elevator type pump system, Model O/M SE-50 ELV, capable of pumping water while restricting pumping of oil. The system shall function automatically and shall provide for an alarm in the event of: (1) the presence of oil in the sump, (2) high liquid level, or (3) high amps or a locked rotor condition. The pump shall be submersible type, UL 778, capable of pumping 50 GPM at 22 feet TDH, with thermal and overload protection. The motor shall be rated at 1/2 HP, 1 phase, 115 volt, 3600 RPM and capable of operating continuously or intermittently. The motor housing shall be constructed of #304 stainless steel, and mechanical seals shall be housed in a separate oil-filled compartment. The control shall be UL 508 approved and housed in a gasketed NEMA 4X enclosure with stainless steel hinged hardware. The control shall include dual relays with variable sensitivity settings, magnetic contactor with separate over-current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with illuminated red light and alarm silencing switch, LED lights indicating power and pump run functions, dual floats, clearly marked terminal board and remote monitoring contact. Unit shall include control cables (length as required), and a cable and plug from the control unit (length as required). Mount control panel 5'-0" above finished floor to bottom of panel. Provide factory wired NEMA 4X junction box in Elevator pit with 8-pin twist-lock receptacle and 25 ft. of heavy duty 8-pin mating cable. Provide cable lengths as required in 25 ft. lengths with 8-pin quick connects on ea20ch end to connect the junction box to the control panel. Provide factory hard wiring of pump, oil probe and floats into junction box. Entire system shall be factory tested and approved by a nationally recognized testing laboratory.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Connect hot water circulating pumps to Building Automation System. Refer to Section 22 0900, INSTRUMENTATION AND CONTROL FOR PLUMBING for domestic hot water circulation system sequence of operation.
- B. Coordinate installation of elevator sump pump equipment and piping with elevator equipment.

3.2 TESTS

- A. Make tests under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat tests.

END OF SECTION

SECTION 221300
DRAINAGE SYSTEMS

PART 1 – GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section and the Contractor is cautioned to read Section 22 00 00 carefully as items of work applicable to this section are included in Section 22 00 00.

1.2 DESCRIPTION OF WORK

- A. The work includes providing a complete plumbing system including, but not necessarily restricted to, the following:
 - 1. Sanitary sewer system to a point five feet away from exterior building walls.
 - 2. Installation and connections to miscellaneous equipment furnished by Owner.
 - 3. Connections to fixtures and equipment provided under other sections of these specification.
 - 4. Miscellaneous work as described herein, as shown on drawings, and as required for a complete system.

1.3 RELATED WORK

- A. Supports: Division 05, METAL FABRICATIONS.
- B. Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.
- C. Pipe Insulation: Section 22 07 00, INSULATION.
- D. Plumbing Fixtures: Section 22 40 00, PLUMBING FIXTURES.

1.4 SUBMITTALS

- A. Manufacturer's shop drawings shall indicate that piping and equipment meet specified codes. In accordance with Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Piping
 - b. Valves
 - c. Floor Drains
 - d. Cleanouts
 - e. Access Panels
 - f. Pipe supports

- g. IGCC Submittals: Submit product documentation indicating VOC content in g/L for all insulation material, field-applied interior adhesives, sealants and mastics.

B. Acceptable Manufacturers: Josam, Mifab, Smith, Wade, Watts, Zurn

PART 2 – PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL CEILING PLATES

- A. Provide in accordance with specifications in Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.

2.2 SOIL, WASTE AND VENT PIPING

- A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately five feet outside of building walls. May be used for piping above ground, where space within partitions involved can accommodate greatest diameter of cast iron soil pipe without any dimension deviation from the requirements of contract drawings. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method. Pipe and fittings shall be listed by NSF International, IAPMO, ICC or other third party organization that is accredited as an ANSI-Guide 65 organization as listed on www.ansi.org. Drains from urinals shall be cast iron or PVC piping.
 - 1. Soil, Waste, and Vent Piping Material (Pipe and Fittings): ASTM A74, ASTM A888 or CISPI 301, service weight.
 - 2. Joints: Provide any one of the following types to suit pipe furnished.
 - a. Lead and oakum and caulked by hand.
 - b. Mechanical: Compression-type (ASTM C564) molded neoprene gasket. Gaskets shall suit class of pipe being jointed. Dual-service gaskets will not be accepted.
 - c. Mechanical: Mechanical joint coupling (ASTM C564) (CSA CAN/CSA-B602) shall be heavy duty and shall consist of a stainless steel coupling and neoprene gasket with center stop. Do not install below grade.
 - d. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leakproof joints.
 - 3. Coating: Provide a heavy coat of asphalt or bitumastic paint on pipe buried in earth or installed in cinders or concrete construction.
 - 4. Cast Iron Soil Pipe Markings: All cast iron soil pipe shall be clearly marked with the manufacturer's name, country of origin, eight-digit date code, pipe diameter and length, relevant ASTM standard and registered trademark of the third party certifier.
 - 5. Material Test Reports: Supplier of cast iron soil pipe shall be able to supply material test reports in accordance with the relevant ASTM standard and shall

include testing and analysis on radioactivity, dimensional characteristics, tensile strength and chemical/metallurgical content. Suppliers shall also supply MSDS sheets on all coatings.

- B. Plastic Pipe: May be used for piping above ground and below ground. Foam core piping is NOT acceptable. All plastic pipe, fittings and components shall be third party certified as conforming to NSF 14 and NSF 61. PVC shall not be used in return air plenums. Schedule 80 PVC nipples will be acceptable for urinal connection.
 - 1. Pipe: PVC Schedule 40 DWV, ASTM D 2665.
 - 2. Soil, Waste, & Vent Fittings: PVC ASTM D3311 fittings for solvent joints.
 - 3. Joints: ASTM F656 purple primer, solvent ASTM D2564 (Not Purple in color) complying with SCAQMD Rule #1168, joints made in accordance with ASTM D2855 and NSF 14.
- C. Foundation Drain Tile: Furnish and install 4" drain tile where indicated on the drawings. The Contractor shall perform all the necessary excavation and backfilling required for this work. Backfill material to a point 8" above the top of the tile and 2" laying bed beneath tile shall be crushed stone furnished by the Contractor. Lines shall be laid without low spots at a uniform slope of approximately 1/16 inch per foot, on 2" gravel bed with open joints. Sub-drain piping shall be corrugated polyethylene tubing and fittings, ASTM F405.

2.3 EXPOSED WASTE PIPING

- A. Finished Room: Use full size chrome plated brass piping for exposed waste piping connecting fixtures, including those furnished by the Owner or specified in other sections.
 - 1. Pipe: Red brass, standard weight, chrome plated.
 - 2. Fittings: Screwed brass or bronze, drainage pattern for waste.
 - 3. Nipples: Brass, standard weight.
- B. Unfinished and Mechanical Rooms: Chrome-plated brass piping is not required. Paint as specified in Section 22 00 00, PLUMBING GENERAL REQUIREMENTS.

2.4 CLEANOUTS

- A. Same size as pipe served up to 4 inches. Cleanouts shall be easily accessible. Provide a minimum of 18-inch clearance for 4 inch and smaller pipes for rodding. Cleanouts shall be provided at the base of each soil stack, waste stack, at all points in sanitary drainage systems where direction change is more than 45 degrees, where required by code, and where indicated on the drawings. All cleanout plugs shall be bronze, set in graphite grease. All cleanout covers shall be secured with vandal resistant screws unless noted otherwise. (ASTM A74, ASME A112.3.1, ASME A112.36.2M) Covers shall be set flush with finished floor or wall unless otherwise indicated. Provide carpet markers in all carpeted areas.

1. Cleanouts at base of vertical stacks: Josam 58600-COT, Smith 4532S, Zurn Z1446 with stainless steel wall cover and tapped for center screw threaded bronze plug. Josam 58540-19 with 58600 wall cover for 8 inch size. Cleanout plug located approximately 30 inches above floor. Cleanout plugs under lavatories and sinks located approximately 10 inches above floor.
2. In horizontal runs above grade: Cleanouts shall be iron body ferrule with bronze screw plug in fitting or tapped cast iron ferrule with bronze plug.
3. In Floors: Floor cleanouts shall have cast iron body, bronze plug, and ABS or cast iron frame with round or square adjustable heavy-duty scoriated vandal resistant nickel bronze top. Unit shall be vertically adjustable for a minimum of two inches. When waterproof membrane is used in floor, provide clamping collars on cleanouts. Cleanouts shall consist of a "Y" fitting and a 1/8 bend. In carpeted areas, provide carpet cleanout markers.
 - a. For mechanical rooms: Josam Series 55000-X-2-SD-VP, Smith 4108C-U, Zurn ZN1400-HD-VP cast iron floor cleanout with vandal resistant heavy-duty round or square tractor cover.
 - b. For light traffic floors: Josam Series 55000-VP, Smith 4028C-U, Zurn ZN1400-VP cast iron floor cleanout with vandal resistant round or square cover plate of satin bronze for finished concrete floors and of nickel-brass elsewhere.
 - c. For vinyl floors: MIFAB C1100-RFC, Jay R. Smith 4021S-F-C-U cast iron floor cleanout with vandal-proof cover plate of satin bronze for finished concrete floors and of nickel-brass elsewhere, with membrane clamp.
4. Exterior Cleanout: Josam Series 55000-X-VP, Smith 4028C-U, Zurn Z1400-VP cast iron floor cleanout with cast iron vandal-resistant heavy-duty tractor cover. Extend cast iron soil pipe from sanitary sewer main two-way cleanout fitting and set cleanout in 12 inch x 12 inch x 6 inch concrete pad for 4 inch size and less, 16 inch x 16 inch x 6 inch pad for larger size. Top of cleanout and concrete pad to be flush with finished surface.

2.5 DRAINS

- A. Floor drains shall have outlets suitable for inside caulking. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane. Puncturing membrane other than for drain opening will not be permitted. All floor drains shall be furnished complete with 4-inch deep seal P-trap. All strainers shall be secured with vandal resistant screws unless noted otherwise. All floor drains and trench drains shall conform to ASME A112.6.3 or CSA B79.
 1. For single stall showers: Josam Series 30000-C-VP with cast iron body and collar, and vandal resistant six inch diameter adjustable non-clog Nikaloy strainer with sediment bucket.
 2. For mechanical rooms and janitor rooms: Josam 30000-E-VP, Smith 2005-D, Zurn Z-415-N coated cast iron floor drain, two-piece body with double drainage flange, WEJLOC invertible non-puncturing flashing collar, weepholes, bottom outlet, adjustable satin Nikaloy vandal resistant round or square medium-duty tractor strainer, and perforated stainless steel basket.

3. For toilets, washrooms, and all other locations: Josam Series 30000-A-VP, Smith 2005-A-VP, Zurn Z-415-B-VP cast iron body and flanged collar, weepholes and vandal resistant six inch diameter Nikaloy strainer.
4. For RPZ backflow preventer: Josam 32100 Series coated cast iron floor drain, two piece body with double drainage flange, Wejloc non-puncturing flashing collar, weepholes 4 inch bottom outlet, round top, with grate.
5. Trap sealer:
 - a. Sure Seal Model SS pre-assembled inline floor drain trap sealer. Sealer shall be constructed of high density polyethylene (HDPE) housing and keeper pin, heavy duty silicone diaphragm and soft EPDM sealing gaskets. Rated for floor ASSE-1072 AF-GW third party testing and listed by IAPMO. Provide in all floor drains.
 - b. Proset Model TG33G-3" and TG34G-4" Preassembled inline floor drain trap guard insert. The trap guard device shall be constructed of PVC insert, "O" Rings for 4 graduated sizes, elastomeric PVC flexible material diaphragm, sealed to pipe with adhesive caulk. Rated for ASME A112.6.3, NSF/ANSI 14 and CSA B79. Provide in all floor drains.
 - c. Mifab "Mi-Gard" Series inline floor drain trap seal device with UV resistant ABS plastic frame, silicon rubber sealing flapper and four flexible sealing ribs. Tested and certified to ASSE 1072 and listed with IAPMO and ICC. Provide in all floor drains.

2.6 TRAPS

- A. Provide traps on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple, cleanout, and setscrew escutcheons. Concealed traps may be rough cast brass. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe and size shall be as required by connected service or fixture. Traps for equipment with acid-resistant drain system shall be of the same material specified for acid-resistant piping or Polypropylene. Provide 4 inch deep seal traps for all floor drains. Provide traps with trap primer connections at all locations where trap primers are indicated.

2.7 AIR ADMITTANCE VALVES

- A. Air Admittance Valves (AAV): Studor "Mini-Vent" Model 20301, or accepted equal, ABS valve with elastomeric membrane, PVC adaptor, protective cover, ASSE approved, conforming to ANSI/ASME 1050 and 1051 and NSF 14. Install with thread seal tape or equal.

2.8 VENT CAP

- A. Vent cap shall be provided where sanitary vent terminates through wall. Vent cap shall be Seiho Model SFX 6S, stainless steel construction. Contractor shall install cap and caulk per manufacturer's instructions.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

1. Suspended horizontal piping shall be supported by adjustable wrought steel clevis hangers. Chain, strap, wire or other make-shift devices will not be permitted as hangers or supports. Hangers on insulated pipes shall go around the insulation, with galvanized sheet steel saddle of sufficient size and thickness to prevent crushing of the insulation. Risers and stacks shall be securely supported and braced in an approved manner. Hangers for plastic piping shall be 4 feet apart. Hangers shall be located at all changes in direction and at each joint for suspended soil, waste or storm branches and mains.
2. Install branch piping for waste from the respective piping systems and connect to all fixtures, outlets, casework, cabinets and equipment, including those furnished by the Owner or specified in other sections of these specifications. Approximate locations for roughing-in are shown on the contract drawings. No piping or roughing-in shall be started until data showing exact locations for equipment and connections required are provided by the Architect. This data shall then be used for roughing-in equipment. Individual traps and other connection components not furnished with the equipment, but required for a complete installation, shall be provided under this section of these specifications. All exposed trim and fixture pipe, except in laundry, shall be chrome-plated.
3. Install trim and fittings provided with casework, cabinets, and laboratories, but not installed at point of fabrication.
4. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, including plastic, shall be reamed to full size after cutting.
5. All pipe runs shall be laid out and scheduled to avoid interferences with other work.
6. Exterior sanitary sewer piping shall have a minimum of 36-inch cover unless indicated otherwise on drawings. Exterior underground PVC piping shall be buried in accordance with ASTM D2321 and the pipe manufacturer's recommendations.
7. Plastic pipe shall not be located in return air ceiling plenums, and shall not be located in above ceiling or attic spaces constructed of combustible material.
8. Plastic pipe shall not penetrate a fire assembly or smokestop. Transitions from metal pipe to plastic pipe must be a minimum of 36 inches away from fire assembly or smokestop penetrations.
9. Screwed joints for steel pipe shall be made with tapered threads, properly cut and all burrs removed. Pipe ends shall be reamed to full size of bore and all filings removed. Joints shall be made tight with an approved joint cement suitable for the service encountered and applied to the male threads only. A maximum of 3 threads shall show after joint is made up.
10. Caulked joints for cast iron sewer pipe shall be made by packing each joint two thirds full with pure tarred rope oakum, and filling remaining 1/3 full of molten lead. Minimum lead depth shall be 2-1/2 inches.

11. Compression gasket joints for cast iron sewer pipe shall be made with neoprene compression gaskets conforming to ASTM C-564 and suitable for use with hub and spigot pipe and fittings. Gaskets shall be installed in strict accordance with manufacturer's recommendations.
12. No-hub joints for cast iron pipes shall be made with neoprene gaskets (ASTM C564) and stainless steel clamps conforming to ASTM C564 AND ASTM C1277. Joints shall be made in accordance with manufacturer's recommendations.
13. Mechanical joints elastomeric sealing sleeve for cast iron pipe shall be in accordance with ASTM C564.
14. Solvent cement for PVC piping shall be handled in accordance with ASTM F402.
15. Drains from urinals shall be cast iron or PVC, with brass or Schedule 80 PVC nipple connecting to urinal. Copper or galvanized steel will not be acceptable.
16. Floor drains shall be installed with top of rim 1 inch below finished floor with floor sloped at 1/8 inch per foot down towards floor drain unless noted otherwise, coordinate with architectural drawings.

B. Piping shall conform to the following:

1. Waste and Rain Conductor:

- a. Slope rain conductor and soil, waste and vent piping as follows:

Pipe Size	Minimum Pitch Down
Soil, waste, and vent	
2-1/2 inch & smaller	1/4 inch to the foot
3 inch & larger	1/8 inch to the foot
Rain conductor	1/8 inch to the foot

- b. Changes in direction of piping shall be made with fittings. Changes in direction of drainage piping shall be made by the appropriate use of long-sweep 1/4 bends, 1/6, 1/8, or 1/16 bends, 45 degree wyes, 1/2 wyes, or a combination of these fittings, except that changes in direction of flow from the horizontal to the vertical may be made with short-sweep 1/4 bends.
- c. ***Contractor is cautioned to locate and verify invert of existing sanitary and storm sewer and to coordinate inverts of new work to suit existing conditions.***
- d. Sanitary sewer shall be provided complete with all plumbing fixtures, drains, etc., properly connected and vented in accordance with the applicable codes. All vents through the roof, including existing vents-through-roof where existing roofing is being replaced and roof slopes are revised, shall extend a minimum of twelve inches above the roof.

3.2 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Refer to Specification Section 220000, Paragraph 3.01.C.1 for requirements for piping above electrical equipment.

3.3 PROTECTION OF PLASTIC PIPE

- A. All plastic piping shall be installed with sufficient distance and insulation relative to recessed light fixtures in accordance with Plastics Pipe Institute (PPI) Technical Note 56 "Installation of Plastic Pressure Piping Materials Near IC-Rated and Non-IC-Rated Recessed Lighting Fixtures".

3.4 TESTS

- A. General: Contractor shall provide all instruments, materials, and labor required. Tests shall be made in the presence of the Owner or Authority having jurisdiction or as otherwise directed by the Architect, who shall be given five (5) days notice by this Contractor of his readiness to perform such tests. Any leaks that develop during the tests shall be repaired by remaking the joint or replacing pipe and fittings. Temporary caulking will not be permitted. No piping shall be insulated or concealed until it has been tested, with results acceptable to the Architect. Except for plastic piping, air testing will be acceptable for other piping materials where permitted by the Virginia Construction Code. Test systems either in its entirety or in sections.
 - 1. All repairs required to existing underground sanitary and storm drainage systems to be reused, where deficiencies are discovered during testing or construction, shall be addressed by change order, or shall be addressed separately by the owner.
- B. Soil, Waste, Rain Conductor and Vent Systems: Conduct tests before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed in accordance with the Virginia Construction Code and this specification.
 - 1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least 10-foot head of water. In testing successive sections, test at least upper 10 feet of next preceding section so that each joint or pipe except uppermost 10-foot head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 - 2. All exterior storm sewers 6 inch diameter and less shall be tested to a minimum of 10 feet of water pressure. Larger sizes shall be visually checked for quality of work, and shall also be checked by a lamp test between manholes and turning points where possible.
 - 3. Final Test: When required by the Building Inspector, conduct as directed in accordance with Virginia Construction Code and this specification. Either one of the following tests may be used:
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke. When smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes. Chemical smoke prohibited.

- b. Peppermint Test: Introduce two ounces of peppermint into each line or stack.
 - c. Air Test: Air test shall be made by forcing air into the system until obtaining a uniform gauge pressure of 5 psi or sufficient to balance a 10 inch column of mercury. This pressure shall be held for a test period of not less than 15 minutes. Testing procedures in excess of 5 psi can result in a dangerous situation and shall not be allowed. Plastic piping shall not be tested using air.
- C. Optional tests for connections to existing systems: After installation of piping and connecting to existing systems, and where hereinbefore specified tests are impractical, test all new piping under actual operating conditions and prove tight to the satisfaction of the Architect.

3.5 CLEANING

- A. After tests have been successfully completed, thoroughly flush the interior drainage system.
- B. Remove trash, plaster, dust, paint spots and all foreign matter from inside and outside of all fixtures and equipment.
- C. The Contractor shall check each length of pipe before it is put in place to make certain there is not foreign material (stones, sand, etc.) in the systems. Provide temporary bypass around equipment if or as required. All plumbing pipes shall be thoroughly flushed with water to remove construction debris before final connections are made to equipment and fixtures.

3.6 REPORTS

- A. Reports of cleaning and testing: Contractor shall verify ***in writing before completion of the job*** that all specified cleaning procedures and tests have been performed, with results as specified or as required by codes.

END OF SECTION

SECTION 223300
DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of this section and the Contractor is cautioned to read Section 22 00 00 carefully as items of work applicable to the section are included in Section 22 00 00.

1.2 DESCRIPTION OF WORK

- A. The work to be performed under this section of the specifications comprises the furnishing of all labor and materials and the completion of all work of this section as shown on the drawings and/or herein specified.
- B. In general, the work included under this section consists of, but is not limited to, the following:
 - 1. Domestic Water Heaters

1.3 RELATED WORK

- A. Section 22 00 00, PLUMBING GENERAL REQUIREMENTS
- B. Section 220700, PLUMBING INSULATION
- C. Circulating Pump: Section 22 11 23, DOMESTIC WATER PUMPS
- D. Section 221300, FACILITY DRAINAGE SYSTEMS
- E. Section 226000, FACILITY NATURAL GAS SYSTEMS

1.4 SUBMITTALS

- A. In accordance with Section 22 00 00, PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Indirect Hot Water Heaters
 - b. Electric Hot Water Heaters
 - c. Gas Hot Water Heaters

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements.
 - 1. Ruud, Rheem, Bock, State, A.O. Smith. PVI

2.2 ELECTRIC WATER HEATER

- A. The heater shall be a glass-lined Custom Xi commercial electric model No. DSE-120 as manufactured by A. O. Smith. Heater should be rated at 45 kW, 480 volts, 3-phase, 50/60 cycle AC and constructed in accordance with ASME Code, shall bear appropriate symbol and be listed with the National Board as required. Heater shall be listed with Underwriters' Laboratories and approved to The National Sanitation Foundation Standard No. 5. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1600F. Tank shall be cathodically protected with powered anodes. The entire vessel is to be enclosed in a round steel enclosure with baked enamel finish. Water heater shall have an electronic control with large LCD displaying current water heater status; provide real time element status and sensing, low water cutoff and economy mode operation. Shall house 120 volt control circuit transformer, transformer fusing, magnetic contractor(s), element fusing per N.E.C., and commercial grade incoloy sheathed flange mounted elements with prewired terminal lead. Temperature controls include limiting switch which will require resetting manually in the event the temperature reaches 190F. Foam insulation shall meet the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IESNA 90.1. heater shall include a CSA Certified and ASME Rated T&P relief valve and drain valve.
- B. Water heater should incorporate the iCOMM system for remote monitoring, leak detection and fault alert.
- C. WHR-1 Electric Water Heater shall be equal to State "ProLine" Model ESX 50 DONT, 50 gallon glass lined tank, two 6 KW elements, 208 volt, single phase, simultaneous wiring, insulation blanket, U.L. 174 certified, 60-1/2 inches tall x 20-1/2 inches diameter, 10 year tank and 10 year parts limited warranty.

PART 3 - EXECUTION

3.1 WATER HEATERS

- A. All water heaters shall have an ANSI Z21.22 temperature and pressure relief valve with test lever. Valves shall have an AGA temperature rated capacity of not less than the installed heating capacity. Discharge pipe shall terminate no more than 6 inches above and not less than two times the discharge pipe diameter above the floor or drain pan flood level rim.

- B. Provide an ANSI Z21.22 Watts 3/4 inch Model LFN36-M1 or equal, bronze body and silicone disc vacuum relief valve on cold water supply to each heater. No valves or connections shall be made between vacuum relief valve and heater.
- C. Standby heat loss for water heaters shall conform to requirements of Section 4.3.1 of ANSI C72.1 and ASHRAE Standard 90-75.
- D. All water heaters shall have warranties equal to those specified for usage or application.
- E. Provide a Watts Model DETA-20 potable water expansion tank on the cold water supply to the water heater. Unit shall have a thermally fused epoxy liner and butyl diaphragm. Precharge tank to domestic water system static pressure. (Support tank from building structure.)
- F. All aspects of installation of water heater shall be in strict accordance with manufacturer's instructions. Materials shall conform with all manufacturer's recommendations and shall include a positive pressure U.L. Listed vent system complying with U.L. 1738. Water heater shall have individually isolating shutoff valves for service and maintenance and a hot water hose connection for field testing.
- G. Contractor shall provide the services of a factory authorized representative to supervise all phases of equipment startup. A letter of compliance with all factory recommendations and installation instructions shall be submitted to the Engineer with operation and maintenance instructions.

3.2 PERFORMANCE TEST

- A. Prove system is balanced and 120 Deg. F is available at farthest outlet from heaters (110 Deg. F. at public lavatories).

3.3 PIPE DISCHARGE

- A. From relief valves to nearest floor drain.

END OF SECTION

SECTION 224000
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 220000, PLUMBING GENERAL REQUIREMENTS, are hereby made a part of the section and the Contractor is cautioned to read Section 220000 carefully as items of work applicable to this section are included in Section 220000.

1.2 DESCRIPTION OF WORK

- A. The work to be performed under this section of the specifications comprises the furnishing of all labor and materials and the completion of all work of this section as shown on the drawings and/or herein specified.
- B. In general, the work included under this section consists of, but is not limited to, the following:
 - 1. Plumbing Fixtures
 - 2. Plumbing Trim

1.3 RELATED WORK

- A. Section 220000, PLUMBING GENERAL REQUIREMENTS.

1.4 SUBMITTALS

- A. In accordance with Section 220000, PLUMBING GENERAL REQUIREMENTS, furnish the following:
 - 1. Manufacturer's Literature and Dimension Cuts:
 - a. Plumbing Fixtures & Carriers
 - b. Plumbing Faucets & Flush Valves
 - c. Plumbing Traps and Fittings
 - d. Plumbing Supplies & Stop Valves
 - e. Plumbing Equipment

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fixtures equal to those as hereinafter specified shall be furnished and installed complete with all supplies, waste and vent connections, all fittings, all necessary hangers and supports, bolt caps, faucets, valves and traps. All trim, except in Janitor's Closets, shall be brass with polished chromium plated finish with chrome setscrew escutcheon at wall, except fixture supply pipes may be chromium plated copper with chrome setscrew escutcheons at wall. Traps shall be cast brass (17 gauge) with cleanout plug. All fixtures shall be white except as otherwise indicated. Handicapped lavatories and sinks shall have both water supplies and trap insulated and wrapped with Handy-Shield (by Plumberex), Handi Lav-Guard (by Truebro) or Prowrap (by McGuire). Where below deck mixing valve or electronic faucet are specified, provide Zurn Model Z6900-V9 vandal guard enclosure or equal by Truebro. Color shall be white and fasteners shall remain out of sight. All electric water coolers and drinking fountains shall have a di-electric fitting on the water supply and PVC trap on waste.

2.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements

Water Closets:	Kohler, American Standard, Toto, Sloan, Zurn
Lavatories:	Kohler, American Standard, Toto, Zurn
Urinals:	Kohler, American Standard, Toto, Sloan, Zurn
Showers:	Kohler, American Standard, Universal-Rundle Lasco, Aqua Glass, Aquarius
Sinks:	Acorn-Sinks, Just, Kohler, Elkay, Toto, American Standard, MR Direct
Mop Sinks:	Florestone, Aqua Glass, Fiat
Electric Water Coolers:	Oasis, Elkay, Halsey Taylor, Murdock
Flush Valves:	Delany, Zurn, Sloan, Hydrotek
Faucets:	Kohler, Chicago, T & S, Zurn, American Standard, MR Direct, Hydrotek
Water Closet Seats:	Kohler, Olsonite, Bemis, Church
Shower Fitting:	American Standard, Kohler, Speakman, Symmons, Controls
Carriers:	J.R. Smith, Zurn, Josam, Mifab

2.3 CODE COMPLIANCE

- A. Manufacturer's shop drawings shall indicate that fixtures, fittings and equipment meet specified codes. Fixtures, fittings or equipment materials for potable water system shall not contain lead. All plumbing fixtures, flush valves, flush valve operators, flush tank operators, faucets, and fittings designated for handicapped installation, shall meet ICC/ANSI A117.1-2017 and The Americans with Disabilities Act 2010 (ADA) requirements. Fittings and fixtures that are connected to potable water systems shall meet the 1996 Safe Water Drinking Act and the 2011 Reduction of Lead in Drinking Water Act, and where

applicable shall meet NSF Standard 61 and shall be labeled and certified. Faucets that supply drinking water shall comply with NSF 9.

B. Codes:

1. Vitreous china fixtures - ASME/ANSI A112.19.2M; ICC/ANSI A117.1-2017; ADA
2. Flush valves - ASSE 1037 with ASSE 1001 vacuum breaker on flush valves; ICC/ANSI A117.1-2017; ADA
3. Lavatory & Closet carrier - ASME/ANSI A112.6.1
4. Electric water coolers - ARI 1010; ICC/ANSI A117.1-2017; ADA. Unit shall be listed by Underwriters Laboratories for both the US and Canada and is to be compliant to ANSI/ASHRAE 18. Unit shall be certified to Public Law 111-380 (NO-LEAD) and NSF/ANSI/CAN 61. Fixture meets ADA, ADA Standing Person, and ADA Child requirements when mounted appropriately.
5. Stainless steel plumbing fixtures (sinks) - A112.19.3M; ICC/ANSI A117.1-2017; ADA
6. Faucets - ASSE 1025; ASME A112.18.1; ICC/ANSI A117.1-2017; ADA; NSF Standard 61 Section 9
7. Showers - ANSI Z124.2; ASME A112.19.9M, CSA B45.5; ADA

2.4 STOPS

- A. Provide lock-shield, loose-key or screw driver pattern polished chromium plated angle stops, with each sink faucet or lavatory faucet. Faucets for mop sinks shall have stops integral with faucet. Locate stops below fixture in accessible location. Flush valves and shower valves shall be furnished with integral stops.

2.5 ESCUTCHEONS

- A. Heavy duty solid type chrome plated brass with set screws.

2.6 ROSETTA SPRAY NON-AERATED CONTROL DEVICE

- A. Smooth, bright stainless steel or satin finish, chrome-plated metal Rosetta spray non-aerated flow device shall provide non-aeration, clear, coherent Rosetta spray control flow device that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.

B. Flow Control Restrictor:

1. Capable of restricting flow between 0.5 GPM to 2.5 GPM for lavatories and for sinks. See fixture specification for GPM requirement for each fixture.
2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 25 and 80 psig.
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning.

- C. Device manufactured by OMNI Products, Inc.

2.7 THERMOSTATIC MIXING VALVE

- A. Provide on all lavatories and sinks Watts Model Series LFUSG-B-M2 under-sink Guardian ASSE 1070 thermostatic tempering valve for single fixture applications and Watts Model Series LFMMV, Bradley S59-4000A, Controls ST70, Powers LFG480 thermostatic mixing valve ASSE 1070 for multiple applications. Set valve for minimum 105 Deg. F, maximum 109 Deg. F.

2.8 FIXTURES

<u>Designation</u>	<u>Standard Fixture Type</u>
WC-1	Water closet: Sloan Royal Optima Wets 2050.1301-1.28-ES, 1.28 GPF HET sensor operated valve, matching wall-mounted 15 inch high floor to rim vitreous china, elongated siphon jet bowl, 1-1/2" top spud, Bemis #1655SSCT white extra heavy duty solid plastic open front seat without cover, self-sustaining check hinge. Sloan Royal Optima ES-S flush valve (ASSE 1037, ANSI A112.19.2) 11-1/2 inches above bowl with solenoid operator, vacuum breaker and vandal resistant control cap assembly. Optima EL-1500-L infrared sensor with indicator light, courtesy flush override button, transformer and two (2) chrome-plated wall cover plates with vandal resistant screws. Provide EL-485A electrical box positioning and support kit, coordinate location with plumbing rough-in and electrical. Provide coordinated closet carrier similar to Josam 12000 Series "chase saver" carrier with applicable fitting.
UR-1	Urinal: Sloan Royal Optima WEUS-1000.1301-0.13 ES-S, .13 GPF water saving, washdown flushing action, Optima sensor operating flush valve. Matching wall-mounted fixture 24 inches floor to top of rim, vitreous china, 3/4 inch top spud. Sloan Royal Optima 186 ESS flush valve (ASSE 1037, ANSI A112.19.2) mounted 11-1/2 inches above top of fixture with solenoid operator, vacuum breaker and vandal resistant control cap assembly. 2-inch outlet, Optima EL-1500 infrared sensor with indicator light, transformer and chrome plated wall cover plate with vandal resistant screws. Provide installation template to coordinate location of sensor and plumbing rough-in and electrical. Provide coordinated urinal carrier similar to Josam Series 17560-UR single carrier with hanger plate, bearing plate, steel pipe uprights and block bases for each urinal.
L-1	Lavatory: American Standard Lucerne 0355.012, 20-1/2 inch x 18-1/4 inch, vitreous china, wall hung, 4-inch centers, Zurn Z6915-XL-MV-CWB-F sensor faucet, 0.5 GPM flow device, grid drain and tailpiece. Provide coordinated lavatory carrier similar to Jay R. Smith 0700 or 0700D double, or Josam Series 17100 single or 17100-BB double carrier with concealed arms steel uprights, screws, and block bases for each lavatory.

MS	Mop Sink: Mop Sink: Fiat Model MSB-2424, Florestone Model MSR-2424, Zurn Model Z1996-24, 24 inch x 24 inch x 10 inch molded stone mop service basin, with Fiat E-77-AA, Florestone MR-373, Zurn BV bumper guard, stainless steel drain body, combination S.S. dome strainer (NOT integral flat strainer) and lint basket, Fiat 830-AA, Florestone MR-371, Zurn Z1996-SF, Chicago 897-RCF supply fitting with vacuum breaker, four arm handles, integral stops, wall brace, pailhook, threaded spout, Fiat 832-AA, Florestone MR-370, Zurn HH rubber hose and wall hook and Fiat 889-CC, Florestone MR-372, Zurn MH mop hanger, and MSG2424 stainless steel wall guards.
LO	Laundry Outlets: Guy Gray or equal washing machine supply and drain connections with hot and cold top hose connections and 2 inch drain connection in galvanized steel wall box, Model BB200TS top supplies. Mount bottom of box 42 inches above finished floor.
IM	Ice Maker Outlet Box: Guy Gray or equal ice maker supply connection box, Model BIM875AB, 20-gauge galvanized steel box and faceplate, 1/4 turn ball valve and hammer arrestor. Install with bottom of box maximum 24 inches above finished floor.
<u>Designation</u>	<u>Handicapped Fixture Type (ADA)</u>
WC-2	Water closet: Sloan Royal Optima Wets 2050.1301-1.28-ES, 1.28 GPF HET sensor operated valve, matching wall-mounted 17 inch high vitreous china, elongated siphon jet bowl, 1-1/2" top spud, Bemis #1655SSCT white extra heavy duty solid plastic open front seat without cover, self-sustaining check hinge. Sloan Royal Optima 111 ESS flush valve (ASSE 1037, ANSI A112.19.2) mounted 11-1/2 inches above bowl with solenoid operator, vacuum breaker and vandal resistant control cap assembly. Optima EL-1500-L infrared sensor with indicator light, courtesy flush override button, transformer and two (2) chrome-plated wall cover plates with vandal resistant screws. Provide EL-485A electrical box positioning and support kit, coordinate location with plumbing rough-in and electrical. Provide coordinated closet carrier similar to Josam 12000 Series "chase-saver" carrier with applicable fitting.
UR-2	Urinal: .13 GPF hardwired 120 VAC/24 VAC Sloan Royal Optima WEUS-1000.1301-0.13 ES-S, .13 GPF water saving, washdown flushing action, Optima sensor operating flush valve. Matching wall-mounted fixture 17 inches floor to top of rim, vitreous china, 3/4 inch top spud. Sloan Royal 186 flush valve (ASSE 1037, ANSI A112.19.2) mounted 11-1/2 inches above top of fixture with solenoid operator, vacuum breaker and vandal resistant control cap assembly. 2-inch outlet, Optima EL-1500 infrared sensor with indicator light, transformer and chrome plated wall cover plate with vandal resistant screws. Provide installation template to coordinate location of sensor and plumbing rough-in and electrical. Provide coordinated urinal carrier

similar to Josam Series 17560-UR single carrier with hanger plate, bearing plate, steel pipe uprights and block bases for each urinal.

- L-2 Lavatory: American Standard Lucerne 0355.012, 20-1/2 inch x 18-1/4 inch, vitreous china, 4-inch centers, wall hung, concealed arms, wall-hung lavatory, faucet ledge, Zurn Z6915-XL-MV-CWB-F sensor faucet, 0.5 GPM flow device, grid drain and tailpiece. Mount top of front rim 34 inches above finished floor. Provide concealed arms carrier similar to Jay R Smith 0700 single or 0700D double or Josam 17100 single or 17100-BB double floor-mounted lavatory carrier with leveling and securing screws, structural uprights and block bases.
- SK-1 Workroom Sink: Elkay "Lustertone" LRAD2219, Acorn-Sinks SDADA-2220, 22" x 19-1/2" x 6-1/2" deep ADA single bowl countertop type 304 18 gauge stainless steel sink, Chicago 1100-GN8AE35-369AB faucet, 8" centers, 8" gooseneck rigid/swing spout, 1.5 GPM at 60 psi discharge laminar flow device, 2-3/8" vandalproof lever handles, LKAD-35 strainer and LKADOS offset tailpiece.
- SK-2 Sink: Elkay "Lustertone" LRAD 3322, Acorn-Sinks DDADA-3322, 33 inch x 22 inch double compartment, self-rimming, 18 gauge, faucet ledgeback, 6-1/2 inch bowl depth, stainless steel with Chicago 1100-GN8AE35-369AB faucet, 8" centers, 8" gooseneck rigid/swing spout, 1.5 GPM at 60 psi discharge laminar flow device, 2-3/8" vandalproof lever handles, LKAD35 strainer and LKADOS offset tailpiece in each compartment.
- EWC-1 Electric water cooler: Elkay Model EZWS-ERPBM28K, ADA, lead-free, two-level, recessed in the wall, air cooled, hermetically-sealed refrigeration system, 18-gauge Type 304 stainless steel satin finish fountain body, 16-gauge Type 304 tubular support arms, Type 304 stainless steel satin finish removable louvered ventilating front panel grille, vandal-resistant flexible guard bubblers with anti-rotation key, vandal-resistant front push buttons, bottle filling station with sensor activation, visual filter monitor, laminar flow, antimicrobial, bottle counter, drain, minimum 7.5 GPH of 50 Deg. F water at 90 Deg. F ambient. Provide wall mounting frame MF200 with stainless steel bolts and screws, chiller shelf and support rods. Secure frame to wall with stainless steel bolts or screws. Mount unit so that low side outlet is 36 inches above finished floor.
- SH-1 Shower: Symmons (ASSE 1016) Temptrol Commercial Model C-96-500-B30-V-X-231-VB pressure balancing mixing valve shower control with adjustable stop screw to limit handle turn, integral service stops, single blade handle, elevated vacuum breaker Levertrol 4-458 diverter with integral volume control, Super shower head with arm and flange, wall/hand shower with 60 inch flexible metal hose, wall connection and flange, 30-inch slide bar for hand shower mounting, and 2.5 GPM flow at 80.0 psi heads. Where shower valves are shown back-to-back,

provide one valve with reverse coring, hot on right, cold on left installation. The shower valve and the shower riser pipes from the diverter valve to the shower arm outlets shall be attached to the building structure in an approved manner. Provide Temptrol rapid install bracket, straps and screws.

SH (Enclosure) Shower: Freedom Showers molded fiberglass with applied gel coat finish. Model APC3838BF1PRF-R, ICC A117.1 – 2017 ANSI Type A, CSA B45.5-11 / IAPMO Z124-2017, exterior outside dimension of 38" x 38" x 77-3/4". 5/8" threshold with pre-leveled and reinforced shower base, 1-1/4" O.D. horizontal stainless steel L-shaped grab-bar, one 1-1/4" diameter vertical 18" bar, L-shaped shower seat model APCSSR2-32225PWSFI. One inch diameter 18-gage stainless steel curtain rod and shower curtain.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Supports and Fastenings: Secure all fixtures, equipment and trimmings to partitions, walls, etc., with brass through bolts, toggle bolts, expansion bolts, or power set fasteners, as required. Exposed heads of bolts and nuts in finished rooms to be hexagonal, polished chromium plated brass with rounded tops.
- B. Through Bolts: For freestanding marble and metal stud partitions.
- C. Toggle Bolts: For hollow masonry units, finished or unfinished.
- D. Expansion Bolts: For brick or concrete or other solid masonry. To be 1/4-inch bolts, 20 threads per inch, and to extend at least three inches into masonry; to be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- E. Power Set Fasteners: May be used for concrete walls, shall be 1/4-inch threaded studs, 20 threads per inch, and shall extend at least 1-1/4 inches into wall.
- F. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- G. Where water closets are wall mounted or floor mounted, lavatories, urinals and water coolers are wall mounted, seal between water closet and wall or floor, and lavatory, urinal, or water cooler and wall, with a silicon caulking compound. Counter mounted lavatories or sinks shall be sealed between countertop and lavatory or sink. Where fixtures are white in color, the caulking compound shall be white. Where fixtures are stainless steel, use transparent caulking compound.

3.2 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

END OF SECTION

SECTION 230000
HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specifications shall be applicable to all phases of mechanical work covered by specifications and drawings issued for this project.
- B. The "General Conditions of the Contract", "Supplementary General Conditions", and all other similar general requirements issued for this project shall apply to all mechanical work and are hereby made a part of this section.
- C. The Contractor and/or his representatives shall be fully acquainted with the design and operation of the systems and equipment described in these specifications and on the drawings.
- D. Work included under this section shall include complete systems as shown on the plans and as specified. Provide supervision, labor, material, equipment, machinery, plant, and other items necessary to complete the mechanical systems. It is the intention of these specifications and drawings to call for finished work, tested, and ready for operation.
- E. Definitions:
 - 1. "Owner" and "Contractor" shall mean the respective parties to the prime contract governing the project. Only one contractor is recognized as a party to this contract. Where the terms "Mechanical Contractor" or "Subcontractor" are used, it is for convenience only.
 - 2. "Architect/Engineer" shall mean the firm and authorized representatives of the firm engaged by the Owner for architectural and engineering services related to this project.
 - 3. "Mechanical" shall mean all work related to air conditioning, heating, ventilation, plumbing, sprinkler systems, noise and vibration control, and similar work, including all related components, accessories, controls, and miscellaneous work required for a complete system.
 - 4. "Contract Documents" shall mean and include the agreement, the drawings and specifications and all modifications thereto authorized by the Owner in writing prior to final completion of the project.
 - a. The term "Agreement" shall mean the completed and signed contract form.
 - b. The term "Drawings" shall mean the drawings prepared by the Architect/Engineer for specific use in bidding and execution of the work.
 - c. The term "Specifications" shall include the legal and procedural documents, the general conditions, special conditions, and the technical specifications.
 - d. The term "Technical Specifications" shall mean that part of the specifications which describes, outlines, and stipulates the kind and quality of the materials to be furnished, the quality of workmanship required, and the methods to be used in the construction under the contract. For convenience, the mechanical

portions of the technical specifications are arranged into one general section and several detailed sections related to the various trades represented in the work. Such arrangement and references shall not operate to make the Architect/Engineer an arbiter in establishing the limits of any subcontract or trade.

5. "Work" of the Contractor shall mean labor or materials or both.
6. "As shown", "as indicated", "as detailed", or words of similar import shall mean reference to the drawings included in the contract documents, unless stated otherwise.
7. "As directed", "as required", "as permitted", "approved", or words of similar import shall mean that the direction, requirement, permission, approval, or acceptance of the Architect/Engineer is intended unless stated otherwise.
8. "As necessary" shall mean that which is necessary to achieve satisfactory completion of the work in order to provide the intended function and form of the project in compliance with the contract documents.
9. "Provide" shall mean "provide complete and in place", that is "furnish and install", ready for beneficial occupancy by the Owner. Except where stated otherwise, description of any work in the contract documents shall mean that the work shall be provided by the Contractor, even though the words "provide" or "furnish and install" do not accompany the description.
10. "Similar" shall be interpreted in a general sense and not as meaning identical, and all related details shall be worked out in respect to their location and their connection with other parts of the work.
11. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
12. Option or Optional: Contractor's choice of an alternate material or method.

1.2 INTENT OF CONTRACT DOCUMENTS

- A. The contract documents are complementary, and what is called for in one place shall be as binding as if called for in all places. Where variances occur between drawings and specifications or within either document itself, include in the contract price the item or arrangement of better quality, greater quantity, or higher cost. Agreement shall take precedence over the specifications and drawings. Figured dimensions shall be used in preference to scaling the drawings. In case of conflict between large and small scale drawings, the large scale drawings shall govern.
- B. The mechanical drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. Architectural and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves, boxes, offsets, transitions, and other accessories as may be required to meet such conditions.

1.3 CODES AND STANDARDS

- A. All materials and workmanship shall comply with all applicable codes, state and federal laws, local ordinances, industry standards, utility company regulations, and all other criteria which normally apply to work of this nature.
- B. In case of difference between building codes, state laws, federal laws, local ordinances, industry standards, utility company regulations, other criteria and the contract documents, the more stringent regulations will apply. The Contractor shall promptly notify the Architect/Engineer in writing of any such difference.
- C. If the Contractor performs any work that does not comply with these contract documents or the requirements of the applicable building codes, state laws, local ordinances, industry standards, utility company regulations, and other applicable criteria, he shall bear all costs arising in correcting the deficiencies.
- D. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed in these specifications. The manufacturer and trades involved shall be familiar with the application of these standards.
- E. Applicable codes and standards shall include, but are not necessarily restricted to, the most recently recognized issues of the following:
 - 1. Building Codes:
 - a. Virginia Uniform Statewide Building Code
 - b. International Mechanical Code and accumulative supplements.
 - 2. Industry Standards, Codes, and Specifications:
 - a. AASHO - American Association of State Highway Officials
 - b. ADA - Americans with Disabilities Act
 - c. AGA - American Gas Association
 - d. ARI - Air Conditioning and Refrigeration Institute
 - e. AMCA- Air Moving and Conditioning Association
 - f. ANSI - American National Standards Institute
 - g. ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers
 - h. ASME - American Society of Mechanical Engineers
 - i. ASSE - American Society of Sanitary Engineering
 - j. ASTM - American Society of Testing and Materials
 - k. AWS - American Welding Society
 - l. CISPI - Cast Iron Soil Pipe Institute
 - m. CSA - Canadian Standards Association
 - n. AWWA- American Water Works Association
 - o. FIA - Factory Insurance Association
 - p. FM - Factory Mutual
 - q. FS - Federal Specification
 - r. IBR - Institute of Boiler and Radiator Manufacturers
 - s. IRI - Industrial Risk Insurers

t.	ISO -	Insurance Services Office
u.	MSS -	Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
v.	NBS -	National Bureau of Standards
w.	NEC -	National Electrical Code
x.	NFPA -	National Fire Protection Association
y.	NSF -	National Sanitation Foundation
z.	PDI -	Plumbing & Drainage Institute
aa.	UL -	Underwriters' Laboratories, Inc.
bb.	SMACNA -	Sheet Metal and Air Conditioning Contractors' National Association
cc.	UFAC -	Uniform Federal Accessibility Standards
dd.	SCAQMD -	South Coast Air Quality Management District
ee.	GS -	Green Seal Standard

1.4 GOVERNMENTAL FEES, PERMITS, AND INSPECTIONS

- A. Under each applicable section of the detailed mechanical specifications, the Contractor shall obtain and pay for all required licenses, permits, charges for connections to outside services, fees and inspections. Upon completion of the work under each section of the detailed mechanical specifications, the Contractor shall furnish a certificate of final inspection to the Architect/Engineer from the governmental inspection department having jurisdiction.

1.5 VISITING THE SITE

- A. Each Contractor shall be responsible for visiting the site before bidding the job to familiarize himself with all existing conditions to be met in the execution of the work under this contract. No additional compensation will be allowed for any changes which may be required to make because of site conditions.

1.6 QUALITY ASSURANCE

- A. Product Criteria:
 - 1. All materials shall be new and shall bear the manufacturer's name, trade name, and the UL label in every case where a standard has been established for this particular material. The equipment to be furnished shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest approved design. All equipment shall bear a permanent and legible factory-applied nameplate to permit identification of manufacturer, model number and type of unit.
 - 2. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Architect/Engineer, reasonably close to the site.
 - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer to provide for uniform appearance, operation, and maintenance.
 - 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

- B. Manufacturers' directions shall be followed in the delivery, storage, protection, and installation of all equipment and materials. The Contractor shall promptly notify the Architect/Engineer in writing of any conflict between any requirements of the contract documents and the written instructions before proceeding with the work. If the Contractor performs any work that does not comply with the manufacturers' directions or such written instructions from the Architect/Engineer, he shall bear all costs arising in correcting the deficiencies.
- C. Factory Start-up by the manufacturer's Factory Certified Representative shall be provided for each Air Handling Unit (Packaged, and Split). Letters signed by the Representative stating that their equipment has been started, tested, and is operating safely shall be submitted to the Owner as part of the bound Operations and Maintenance Instructions manual specified in section 2.10 CATALOG DATA FOR OWNER of this specification.

1.7 BIDDING INSTRUCTIONS

- A. Products are generally specified by a performance specification and/or by manufacturer's name and model number or trade name.
- B. When specified only by a performance specification, the Contractor may use any manufacturer who meets the performance specification and applicable codes. (The Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS.)
- C. When several products/manufacturers are specified together, then the Contractor has the option of using any product/manufacturer listed. The Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS. The Contractor's bid shall be compiled on the use of the listed products without exception. Substitutions will only be considered after the contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS.
- D. When several products/manufacturers are specified together and the system design is based on one of the listed products by specific model number(s) or catalog number(s), then the Contractor has the option of using the one specific product or any other product/manufacturer listed. In either case, the Contractor shall be subject to the requirements of 1.9 - SHOP DRAWINGS. However, when the other listed product/manufacturer is used, the Contractor shall be responsible for determining that the product(s) will be compatible with building design, electrical design, mechanical design, and the product(s) will not necessitate design modifications by the Architect/Engineer. The Contractor's bid shall be compiled on the use of the listed products without exception. Substitutions will only be considered after the Contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS. If the products/manufacturer are listed to be "only", then substitutions will not be considered.
- E. When only one manufacturer's name is listed, this shall be the basis of the bid. The Contractor's bid shall be compiled on the use of the listed product. Substitutions will only be considered after the Contract has been executed and shall be subject to the requirements of 1.8 - SUBSTITUTIONS.

1.8 SUBSTITUTIONS

- A. Substitutions will not be considered during the bid.
- B. After the Contract has been executed, the Architect/Engineer will consider a formal request for a review of substituted products in place of those specified, under the following conditions:
 - 1. Not later than 30 days from the Contract Date, the Contractor shall provide a list of products proposed as substitutions, including the name, manufacturer, and section of the specifications governing the product.
 - 2. The request shall be accompanied by accurate cost data on the proposed substitutions indicating whether or not a modification of the Contract Sum is to be considered.
- C. Substitutions are understood to mean that the installing Contractor:
 - 1. Has personally investigated the proposed substitute and has determined that it is equal or superior in all respects to the item specified;
 - 2. Will provide the same guarantee for the substitution that he would for the item or equipment specified;
 - 3. Certifies that the cost data is complete and includes all related costs under this Contract, and waives all claims for additional cost related to the installation of the accepted substitute;
 - 4. Has coordinated the installation of the substitute, providing design modifications and changes as required for the work to be complete in all respects;
 - 5. Has coordinated the installation of the substitute with the General Contractor pertaining to changes required for the work to be complete with all trades and all changes shall be provided without additional cost to the Owner.
- D. The acceptance by the Architect/Engineer of any or all of those substitute items listed by the Contractor for review shall not constitute an approval of the substitute but shall mean that the Contractor may then submit detailed shop drawings for review. When a request for substitution is granted, shop drawings will be reviewed by the Architect/Engineer. Shop drawings not complete with proper review information will not be reviewed and will be returned unchecked. If after two submittals, the substitute equipment is not approved, the specified equipment shall be provided.

1.9 SHOP DRAWINGS

- A. Shop Drawings are required for all material and equipment that is specified by a manufacturer's name or as indicated in the technical specifications. Submittal data for related equipment shall be submitted at one time and shall be submitted as a digital file (pdf). Allow 10 business days for review of shop drawing submittals, starting from the date LPA, Inc. receives the submittals.
- B. Substitutions will not be considered if:
 - 1. They are indicated or implied on shop drawing submissions without information specified in 1.8 - SUBSTITUTIONS.

2. They require a substantial revision of the Contract Documents in order to accommodate their use.
- C. Identify submittals with PROJECT NAME and NUMBER, CONTRACTOR'S NAME, SECTION NUMBER & NAME, and PARAGRAPH NUMBER of SPECIFICATION GOVERNING, MANUFACTURER, MODEL or STYLE, and CONTRACTOR's REVIEW STAMP. Submittals shall be detailed, dimensioned drawings showing construction, size and arrangement, service clearances, performance characteristics, and capacity. Submittals not properly identified or containing information of a general nature will not be reviewed and will be returned unchecked.
 - D. Acceptance of shop drawings shall not be considered as a guarantee of measurements or building conditions. Acceptance shall not relieve the Contractor from the responsibility or necessity of furnishing material or performing work required by the drawings and specifications. Submittal data on any one item shall not be reviewed more than three (3) times. If not accepted after the third review, the Contractor shall provide the equipment upon which the design was based.
 - E. Failure to submit shop drawings in ample time for checking shall not entitle an extension of contract time, and no claim for extension by reason of such default will be allowed.
 - F. No material or equipment, for which submittals are required, may be delivered to or installed at the job site until submittals have been accepted.
 - G. Unless a specific finish is indicated in the contract documents, wherever a choice of finish is available for the specified item, submit accurate color chips or charts to the Architect for review and selection.
- 1.10 OPERATING AND MAINTENANCE MANUALS
- A. Operating and Maintenance Manuals shall be submitted with close-out documents as separate comprehensive digital files (pdf) containing all materials related to each specific Division and named to reflect that particular Division. O&M Manuals will not be accepted if material for more than one division is combined into one file. O&M Manuals will not be accepted if materials for a particular division are submitted separately.

PART 2 - PRODUCTS

2.1 DRIVE GUARDS

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.
- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- C. Access for Speed Measurement: One-inch diameter hole at each shaft center.

- D. Lubrication: Guards shall not interfere with lubrication of equipment.

2.2 PAINTING

- A. General - Paint mechanical and electrical equipment and material in Equipment Rooms and utility type areas and located outside of the building or on the roof. Painting of equipment and material in finished rooms or areas shall be accomplished as described in PAINTING Section of the Architectural Specifications. Painting in concealed spaces shall be limited to equipment and materials not otherwise protected from rusting such as hangers and supports. Paint shall be products of Sherwin-Williams, Pittsburgh, or Pratt-Lambert. All paints, finishes and coatings shall comply with Green Seal Standard GS-11, GS-03, and SCAQMD Rule #1113 VOC limits for paints and coatings
- B. Workmanship - The work shall be accomplished by workmen skilled in the painting trade after testing is complete and systems are ready for operation. Surfaces to be painted shall be completely dry before applying paint. Surfaces shall not be painted when the temperature is below 50 Deg. F or above 120 Deg. F, or when they are exposed to hot sun. Materials shall be evenly spread and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coat. The painters shall protect adjacent surfaces with drip covers during the process of painting. Upon completion, paint spots, if any, shall be removed from adjacent surfaces.
- C. Preparation of surface - Metal surfaces shall be cleaned with solvent before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be pretreated with a phosphoric acid cleaning solution and primed with Sherwin-Williams "Galvanized Iron Primer".
- D. Painting - After preparation as described above, each item shall be painted as follows, except color of paint for equipment and material located outside of the building or on the roof shall be as selected by the Architect.
 - 1. Painting is not required of equipment, equipment supports, and hangers with a factory-finish coat. Patch painting is required of any damaged areas to match factory-finish coat. Painting is required where equipment or equipment supports do not have factory-finish paint. Painting shall be as follows:
 - a. Equipment and associated hangers and supports shall be primed with one coat of alkyd, zinc potassium chromate metal primer, except insulated surfaces shall be primed with one coat Sherwin-Williams "Wall Primer and Sealer." Finish with two coats of Sherwin-Williams Steel Gray Enamel. Exterior of belt guards and other protective guards shall be finished with two coats of machinery enamel in OSHA yellow color. Interior of items covered by belt guards and other protective guards shall be finished with two coats of machinery enamel in OSHA orange color. Nameplates on equipment shall not be painted.
 - 2. Ducts, pipes, and conduits - Interior duct behind grilles, registers, and diffusers shall have 1 finish coat of Sherwin-Williams Black Enamel. Exposed duct, pipes, conduits, and associated hangers exposed in equipment rooms and other unfinished

areas such as storage areas shall have two finish coats of paint of the same color as adjacent walls or ceilings. Bare copper pipe shall not be painted. Canvas or paper jacket insulation of pipes or duct exposed in unfinished areas shall be primed and sealed before final two coats of paint. Hangers and supports in concealed areas not protected by factory-finish paint shall have one coat of metal primer.

E. Identification of pipes and equipment

1. Equipment - Each piece of equipment shall be identified by engraved nameplate that will read the same as the identification shown on mechanical or electrical drawings. Engraved name plates not less than 1" height, white letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting. Seton Name Plate Company, EMED Co., Marking Services Inc., or equal.
2. Pipes shall be identified using pre-printed markers sized appropriately for the pipes being identified (shop drawings required). Markers shall be Seton "Setmark" type or equal. Pipe identification shall meet the most current edition of ANSI Specification A13.1. Markers shall be located close to valves or flanges and adjacent to changes in direction, branches and where pipes pass through walls or floors, and at intervals of 15 feet on straight runs. Provide a Color Code Chart, framed with glass front, indicating piping service and color code schedule. Post in Mechanical Room where directed by Engineer.

- F. Equipment locations above acoustic tile ceilings: Provide colored brass push-pins complete with a minimum 1/2" shank and 5/8" diameter head. Pin head color shall be blue or color as selected by Architect or Owner. Locate push-pins directly below all scheduled mechanical equipment.

2.3 MOTORS, CONTROL, AND ELECTRICAL WIRING

- A. Provide motors in accordance with NEMA Standards and suitably designed to match the starting and running characteristics of the driven equipment. Unless indicated otherwise, motors less than 1/2 horsepower shall be wound for 120 volt, single phase, 60 hertz. Motors 1/2 horsepower and above, unless indicated otherwise, shall be wound for three phase, 60 hertz, 200 volt, 230 volt, or 460 volt as required by the system voltage. Select motors coordinated with the utilization voltage and phase. Motors for equipment with VFD shall be matched to the VFD.
- B. All starters and safety switches, except for those specified to be furnished with the mechanical equipment, shall be furnished as part of the Electrical Work - Division 26.
- C. Starters and safety switches furnished with the mechanical equipment shall comply with the specifications of Sections 26 28 16 and 26 29 13.13. Starters furnished as an integral part of the mechanical equipment shall be complete with properly sized overload heaters. Integral 3-phase motor starters and VFD's shall be provided with phase loss protection.
- D. Temperature control wiring shall be furnished as part of the Mechanical Work, Section 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC. Temperature control wiring is any wiring, regardless of voltage, related to mechanical equipment that is not the equipment power circuit from the circuit breaker in the panelboard to the motor starter or safety disconnect switch and to the motor or equipment junction box. Temperature control

wiring shall include, regardless of voltage, power for control panels, power for actuators, signal for input and outputs, interlocks, and line voltage as herein specified to provide the proper operation and sequence of control for all heating, ventilating, and air conditioning equipment. All wiring shall conform to applicable sections of Division 26, 27 and 28 of the specifications.

1. Power for control panels shall be provided by Controls Contractor and shall be obtained from nearest receptacle or unswitched 120 volt lighting circuit. Control Contractor shall coordinate with Electrical Contractor when connecting to these circuits. Circuit directories in panelboards shall indicate where control panels are connected. When control panels require voltage other than 120 VAC, Control Contractor shall provide transformer to reduce voltage. All wiring shall conform to applicable sections of Division 26, 27 and 28 of the specifications.
2. Power for damper actuators and valves which are an integral part of mechanical equipment shall be provided by the Controls Contractor and shall be obtained from the power source to the equipment or the nearest receptacle circuit. Where power requirement for the actuator or valve is different from that supplied to the equipment, the Controls Contractor shall provide a transformer or tap the nearest receptacle circuit or unswitched 120 volt lighting circuit. Dampers located at fans shall be considered an integral part of the mechanical equipment and shall be factory wired to the equipment power source.
3. Where equipment is controlled by a line voltage control device (thermostat, On-Off switch, Speed Switch, etc.) the Controls Contractor shall wire from the control device to the equipment, unless specifically indicated otherwise on the drawings.
4. Where control devices that are intended to interrupt the motor or equipment power circuit are provided by the Control System Contractor and are mounted other than on or directly adjacent to the controlled equipment, the Control System Contractor shall provide wiring through these devices regardless of voltage or phases.
5. All low voltage control wiring in inaccessible areas or in exposed areas shall be in metal conduit and shall comply with the specifications of Divisions 26, 27 and 28. All low voltage control wiring in unexposed, accessible areas shall be wire in conduit or U.L. approved plenum rated cable supported from the structure with ties spaced 4'-0" on center. Cable shall not be supported on ceiling, lights, or pipes. All low voltage control wiring penetrating walls or floors shall be in conduits. All 120 volt wiring shall be wire in conduit and shall comply with the specifications of Division 26, 27 and 28. All wall-mounted thermostats, sensors, and switches shall be mounted in recessed metal rough-in box.
6. The Controls Contractor shall coordinate with the Electrical Contractor all 120 volt power source, connections required for the controls system. The Controls Contractor shall verify that wiring of motors and controls provides the correct sequence of operation.
7. All equipment that has electrical connections shall have wiring terminals/connectors rated for not less than 75 deg. C. If terminals/connectors are provided and are rated for less than 75 deg. C., the mechanical contractor shall incur all costs associated with upsizing wire and conduit as required by the National Electrical Code.

2.4 FIRE-STOPPING

- A. Pipe penetrations of rated walls, floors, and floor-ceiling assemblies shall be constructed in accordance with Underwriter's Laboratories, Inc., Fire Resistance Directory, Volume II,

Hourly Ratings for Through Firestop Penetrations. The Contractor shall provide U.L. firestop penetrations according to the particular wall, floor, or floor-ceiling assembly rating, construction type, pipe material, pipe size, insulation requirements, sleeve requirements, and the contractor's choice of firestop products as listed by U.L. Refer to the architectural drawings for the wall, floor, or floor-ceiling assembly construction types and ratings.

2.5 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Under each applicable section of the detailed mechanical specifications, the Contractor shall furnish and install all accessories, connections, bases, guards, supports, and incidental items necessary to fully complete the work, ready for use, occupancy, and operation by the Owner.
- B. Type Numbers Specified: MSS SP-58; for selection and application, MSS SP-69. Refer to Section METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction
 - 1. Concrete Insert: MSS SP-69, Type 18
 - 2. Self-Drilling Expansion Shields and Machine Bolt Expansion Anchors: Fed. Spec. FF-S-325, permitted in concrete not less than four inches thick. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-235.
 - 3. Power-Driven Fasteners: Permitted in existing concrete or masonry not less than four inches thick when approved by the Architect/ Engineer for each job condition. Use fasteners capable of supporting a 1000 pound test load, with the actual load not exceeding 50 pounds.
- D. For Attachment to Steel Construction; MSS SP-69:
 - 1. Welded Attachment: Type 22.
 - 2. Beam Clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used on steel beams only for individual copper tubing up to 7/8-inch outside diameter. Beam clamps on steel joists shall be concentric loading type. Beam clamps that are attached to only one side of a joist are NOT acceptable.
- E. Attachment to Metal Pan or Deck: As required for materials specified in Section METAL DECKING.
- F. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A 36 or A 575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turnbuckles shall provide 1-1/2 inches minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 1-1/2 inches by 1-1/2 inches, No. 12 gage, designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping, fire and sprinkler piping, or chemical waste drain piping.

1. Allowable Hanger Load: Manufacturers rating less 200 pounds.
 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 1/4-inch U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 2-inch galvanized steel bands, for insulated piping at each hanger.
- I. Pipe Hangers and Supports: Use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 00, HVAC INSULATION, for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports. Provide Type 40 insulation shields at all other types of supports and hangers including those for pre-insulated piping.
1. General Types (MSS SP-69):
 - a. Standard Clevis Hanger: Type 1; provide locknut.
 - b. Riser Clamps: Type 8 or 42.
 - c. Wall Brackets: Types 31, 32, or 33.
 - d. Roller Supports: Type 41, 43 and 46.
 - e. Saddle Support: Type 36, 37, or 38.
 - f. Turnbuckle: Types 13 or 15.
 - g. U-Bolt Clamp: Type 24.
 - h. For Uninsulated Copper Tube: Material compatible for use with copper to prevent electrolysis.
 - i. Supports for Plastic or Glass Piping: As recommended by the pipe manufacturer.
 2. HVAC Piping: Spring Supports (Expansion and Contraction of Vertical Piping):
 - a. Movement up to 3/4-Inch: Type 51 or 52 variable spring unit with integral turnbuckle and load indicator.
 - b. Movement more than 3/4-Inch: Type 54 or 55 constant support unit with integral adjusting nut, turnbuckle, and travel position indicator.
- J. Support hubless cast iron pipe and fittings per CISPI 301-12. Brace hubless cast iron pipe and fittings 5 inches and larger using Holdrite 117 Series No-Hub Pipe and Fitting Restraints or approved equal.
- K. Concrete Equipment Bases: Unless otherwise noted on the drawings or in the specifications, concrete pads and bases not less than 4 inches high and which project not less than 4 inches beyond the equipment on all sides shall be provided for floor-mounted air handling units, outdoor condensing units at grade, and other similar floor-mounted equipment which normally requires foundations. Concrete shall conform to requirements in the concrete section of these specifications. The trade responsible for the supported equipment shall establish sizes and locations of the various concrete bases required and shall provide all necessary anchor bolts, together with templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with a suitable plate at bottom end of sleeve to hold the bolt. When indicated in the drawings or detailed specifications, other floor-mounted items of equipment shall have a similar concrete base. Special vibration isolation foundations that are required are specified in the detailed specifications.

2.6 PIPE SLEEVES

- A. Locate sleeves during normal course of work. Provide sleeves for piping and conduit passing through concrete floor slabs and concrete, masonry, tile, and gypsum wall construction. Sleeves shall not be provided for piping and conduit running embedded in concrete or slab on grade, except that copper piping shall require sleeves through slabs on grade. Sleeves through structural members shall be only as directed by Architect. In interior wall, provide 1/4 inch space all around between sleeve and conduit, piping, or insulation of piping.
- B. Where sleeves are located through fire-rated walls and floor/ceiling assemblies, provide sleeves and protect the penetration in accordance with Underwriter's Laboratories, Inc., Fire Resistance Directory, Volume II, Ratings for Through Firestop Penetrations.
- C. Sleeves in mechanical rooms with floor drains or hose bibbs shall extend 4 inches above floor. Provide flanges or flashing rings with sleeves in floors with waterproof membrane and clamp or flash into the membrane. Provide sleeves flush with floor in other rooms.
- D. Sleeves shall be constructed of 20 gage galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated.
- E. Fasten sleeves securely in floors or 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 from being forced into the space between pipe and sleeve during construction.

2.7 WALL, FLOOR AND CEILING PLATES (ESCUTCHEONS)

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with setscrew for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes, and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 3/32-inch for floor plates. For wall and ceiling plates, not less than 0.025 for up to 3-inch pipe, 0.035 for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, except mechanical rooms.

2.8 ACCESS PANELS

- A. Under each applicable section of the detailed mechanical specifications, the Contractor shall provide access panels in all locations where required for access to concealed valves, traps, air cushions, controls, dampers, damper operators, junction boxes, and any other equipment or materials requiring inspection or maintenance. Access panels shall be of adequate size and properly located so that concealed items will be readily accessible for servicing or for removing and replacing if necessary, except as indicated or specified otherwise. Access panels are not required in ceilings formed of removable acoustical panels.

- B. Access panels that are not fire-rated shall be Milcor or equal. Provide modular-sized access panels in inaccessible acoustic tile ceilings sized according to the tile size. Provide Milcor metal access panels with cam lock and mounting trim to match finish encountered. Provide natural anodized aluminum finish for panels in kitchens and toilets. Provide prime finished steel for panels in other areas. Paint panels in finished areas to match finish surface.
- C. Where indicated and where access panels are installed in walls of shafts that are not sealed at each floor, access panels shall be Milcor or equal "Fire-Rated" and shall bear the Underwriters' Laboratories, Inc. Class B, 1-1/2 hour label. Openings shall be framed in accordance with the access panel manufacturer's recommendations. Frames shall be not lighter than 16-gage steel. Panels shall be not lighter than 20-gage steel and shall be insulated sandwich type. Panels shall have a continuous hinge, self-lubricating lock, a direct action-knurled knob, and an interior latch release mechanism.

2.9 CHARTS, DIAGRAMS, AND SCHEMES

- A. Charts, diagrams, and schemes listed below shall be provided under each applicable section of the detailed mechanical specifications by the Contractor, framed under glass, and installed where shown on the drawings or directed in the field. All charts, diagrams, and schemes shall be complete, neat, clear, legible, and permanent.
- B. Electric sequence control diagrams of all mechanical system components.
- C. Automatic temperature control diagrams identified as to name, sequence of operation, location, function, temperature setting, spring range, and manufacturer's part number.
- D. Valve identification chart with typewritten schedule of all valves giving their tag number, description, system served, and normal operation position.
- E. Piping schemes where required by the detailed specifications.

2.10 CATALOG DATA FOR OWNER

- A. Furnish one (1) bound copy or one (1) digital file (pdf format) of all Catalog Data on each manufactured item of equipment used in the mechanical work, complete with index listing the products alphabetically by name, together with the names and addresses of manufacturers, sales, and service representatives. Furnish two (2) bound copies or one (1) digital file (pdf format) of all Operating and Maintenance Instructions of each item of equipment. A single comprehensive file or digital file of all Catalog Data and Operating and Maintenance Instructions shall be submitted to the Engineer for review prior to transmittal to the Owner. Single sections or multiple files will not be reviewed.

2.11 RECORD OF AS-BUILTS AND CONDITIONS

- A. Provide a complete set of prints of mechanical plans marked to indicate as-built conditions which are different from those shown on the original construction documents. Site as-built conditions which are different from the construction documents shall be dimensioned from building or identifiable marker. Accurate locations of all concealed utility lines, both interior and exterior shall be recorded. These drawings shall be delivered to the Architect/Engineer before being turned over to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordination of Work:

1. The Contractor shall compare the mechanical drawings and specifications with the drawings and specifications of other trades, and shall report any discrepancies between them to the Architect/Engineer, and shall obtain from him written instructions for changes necessary in the mechanical work. The mechanical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor shall make proper provision to avoid interferences in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.
2. Anchor bolts, sleeves, inserts, and supports that may be required for the work shall be fully coordinated and compatible with the related equipment or materials. Locations shall be determined by the trade installing the related equipment or materials.
3. Slots, chases, openings, and recesses through floors, walls, ceilings, roofs, and partitions shall be located by the trades requiring them.
4. Locations of pipes, ducts, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The installing Contractors shall coordinate their work to the building structure and to other trades as directed by the General Contractor. No additional compensation or extension of completion time will be granted for extra work caused by a lack of coordination. The installing Contractor shall provide dimensions and locations of all openings, shafts, and similar items to the General Contractor for his coordination and execution. Work shall be installed as required so as not to interfere with or delay the building construction. Pipes, ducts, etc., shall be concealed above ceilings, in walls, or in floors as applicable in all areas of the building except in equipment rooms, unfinished storage rooms, or other areas specifically noted to the contrary.
 - a. Right-of-Way: Lines which pitch shall have right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
 - b. Offsets, transitions, and changes in direction of pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all

traps, drains, air vents, sanitary vents, etc., as required to affect these offsets, transitions, and changes in direction.

5. Exact locations of items such as diffusers, grilles, thermostats, hose bibbs, wall hydrants, and other similar items in finished areas of the building and on the exterior of the building shall be coordinated with each other, the building structure, and architectural features thereof so as to be aligned with or centered on other items as applicable. Locations indicated on the drawings are approximate. Trades shall coordinate their work with door swings, block coursing, tile arrangement, and other similar features before establishing the location of any components. Before any related work has begun, the Architect/Engineer may direct reasonable minor changes in equipment locations with no increase in contract price to the Owner. Thermostats shall be mounted so that the top of the thermostat is 48" above the floor and aligned with the top of the light switch plates and 8" from the light switch if shown on the drawings adjacent to a light switch. Room thermostat locations shall be coordinated with door swings, light switches and other wall mounted items. Corridor thermostats shall be mounted 60" above finished floor. Before roughing in conduit or pipe, verify the location of equipment to be connected.
6. Installation and Arrangement: The Contractor shall install all mechanical work to permit removal of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes, ducts, and equipment to permit ready access to valves, cocks, traps, motors, control components, and to clear the openings of swinging and overhead doors and of access panels.
7. Ductwork: The Contractor shall change the cross-sectional dimensions of ductwork when required to meet job conditions but shall maintain at least the same equivalent cross-sectional area. The Contractor shall secure the approval of the Architect/Engineer prior to fabrication of ductwork requiring substantial changes. Ductwork shall not be fabricated until coordination with available space.
8. Drawings by Contractor: When directed by the Architect/Engineer, the Contractor shall submit for review by Architect/Engineer drawings clearly showing certain portions of the mechanical work and its relation to the work of other trades before beginning shop fabrication or erection in the field.
9. Dimensions: The Contractor shall ensure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suite the true intent and meaning of the drawings and specifications. If he concludes that there is insufficient space for installation or specified materials, he shall immediately notify the Architect/Engineer of the conflict and shall stop affected work until he receives instructions as to how to proceed from the Architect/Engineer.
10. Damage to Work: The Contractor is responsible for damage caused by his work or workmen. Repairing of damaged work shall be done by the Contractor as directed by the Engineer at no additional cost.
11. The Contractor shall be responsible for any interruptions to existing services and shall repair any damages to existing systems caused by his operations.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items, in the opinion of the Architect/Engineer, shall be replaced.
2. All items subject to moisture damage (such as controls and electrical equipment) shall be stored in dry, heated spaces.
3. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical or mechanical injury. Clean mechanical equipment to remove dust, oil, dirt, plaster, mortar, trash, or paint. Piping, conduit, and ductwork shall be blown out or flushed of all foreign matter before wires are pulled in or before connections are made to equipment or systems. (Clean each boiler in accordance with manufacturer's instructions before connecting to the system.) Provide temporary filters for air units that are operated during construction. After all construction dirt has been removed from the building, install new filters in air units.

C. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.

D. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

3.2 PIPING

A. Under each applicable section of the detailed mechanical specifications, the Contractor shall furnish and install as shown on the drawings or as necessary to complete the working system in accordance with the intent of the drawings and specifications, a complete system of piping, valves, supports, anchors, sleeves, and all other appurtenances. The piping drawings are diagrammatic and indicate the general location and connections. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve the Contractor of responsibility for the proper erection of systems of piping in every respect suitable for the work intended as described in the specifications and as approved by the Architect/Engineer. Wherever two dissimilar metals join in any piping system, install a dielectric fitting at their intersection.

B. Installation: Piping shall be properly supported and adequate provisions shall be made for expansion, contraction, slope, and anchorage without damage to joints or hangers. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe extending through the roof shall be properly flashed. All changes in direction shall be made with fittings. Wherever pipe hanger bears directly on the pipe being supported, the hanger shall be of the same material as the pipe.

- C. Arrangement: All piping shall be arranged so as not to interfere with removal of other equipment or devices nor to block access to doors, windows, manholes, or other access openings. Piping shall be arranged so as to facilitate removal of tube bundles. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment. Piping shall be placed and installed so that there will be no interference with the installation of the equipment, ducts, etc. All piping shall be installed to ensure noiseless circulation. All piping shall be erected and pitched to ensure proper drainage. Piping shall be installed so as to avoid liquid or air pockets throughout the work. Pipe in finished areas shall be concealed. Exposed piping shall be installed in practical alignment with the building. All valves and specialties shall be placed to permit easy operation and access, and all valves shall be regulated, packed, and glands adjusted at the completion of the work before final acceptance. Water pipes shall not be installed in attic spaces, crawl spaces or similar areas which are subject to freezing, unless indicated to be heat traced.

3.3 PIPE AND EQUIPMENT SUPPORTS

- A. Supports: The Contractor shall support plumb, rigid, and true to line all work and equipment furnished under each section of these specifications. The Contractor shall study thoroughly all general, structural, and mechanical drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted, or suspended, and shall provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support, whether or not shown on the drawings. When directed, the Contractor shall submit drawings showing supports for review by the Architect/Engineer.
- B. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Architect/Engineer.
- C. Use of chain, wire or strap hangers; wood for blocking stays or bracing; or hangers suspended from piping above will not be permitted. If products are rusty, replace or thoroughly clean and coat with prime paint.
- D. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 2-inch clearance between pipe or pipe covering and adjacent work.
- E. Horizontal Pipe Support Spacing:
1. Cast Iron: Five feet on centers maximum spacing. At least one hanger on each full length of pipe, close to hub where possible and at least one within 24 inches of each fitting, and wherever else required to prevent tendency toward deflection due to load. Provide a hanger at upper angle at each drop. Locate hangers adjacent to hubs on multiple fittings not more than four feet on centers.
 2. For support spacing of all other horizontal piping, refer to MSS SP-69 and provide additional supports at valves, strainers, inline pumps and other heavy components. Provide a support within one foot of each elbow.

F. Vertical Pipe Supports:

1. Vertical runs less than 15 feet long may be supported by the hangers on the connecting horizontal runs.
2. Up to 6-Inch Pipe, 60 Feet Long or Not Over 12-Inch Pipe Up to 30 Feet Long: Riser clamps bolted to pipe below couplings or welded to pipe and resting securely on the building structure.

G. Connections: All piping connecting to equipment shall be installed without strain at the piping connection. The Contractor shall be required as directed to remove the bolts in flanged connections or to disconnect piping to demonstrate that piping has been so connected.

3.4 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-Connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.5 CUTTING AND PATCHING

- A. The Contractor shall be responsible for all required digging, cutting, etc., incident to the work, and shall thereafter make all required repairs necessary to restore the cut structure or material to the condition existing prior to the cutting. In no case shall the Contractor cut into any major structural element, beam, or column without the written approval of the Architect/Engineer. All cutting, patching, repairing, or replacing of work required because of fault, error, tardiness, or damage by any trade shall be performed with no increase in the contract price to the Owner.

3.6 LUBRICATION

- A. Under each applicable section of the detailed mechanical specifications, the Contractor shall provide all oil and grease required for the operation of all equipment until acceptance by the Owner. The type and application of all lubricants shall conform to the recommendations of the manufacturer of the equipment involved. The Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the project. This Contractor shall be required to protect all bearings during installation and shall thoroughly grease or otherwise protect steel shafts and other bare ferrous parts to prevent corrosion. All equipment shall be provided with covers as necessary for proper protection against damage or deterioration during construction.

3.7 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 23 05 93, TESTING, ADJUSTING AND BALANCING FOR HVAC, and submit the test reports and records to the Architect/Engineer.

- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of the work.

3.8 QUIET OPERATION AND VIBRATION

- A. Systems shall operate under conditions of load without unusual or excessive noise or vibration. Unusual or excessive noise or vibration shall be corrected.

3.9 INSTRUCTIONS TO OWNER'S PERSONNEL

- A. Under each applicable section of the detailed mechanical specifications, the Contractor shall instruct the representative of the Owner in the proper operation and maintenance of all elements of the mechanical systems. A competent representative of the Contractor shall no more than one day in such formal instruction and shall spend such additional time as directed by the Architect/Engineer to fully prepare the Owner to operate and maintain the mechanical systems. The Contractor shall provide letter of instruction upon completion to the Architect/Engineer stating the date of instruction and the names of those in attendance.

3.10 GUARANTEE

- A. All mechanical equipment, materials, and labor required by the contract documents for this project shall be guaranteed to be free of defective materials or workmanship for a period of one year after final acceptance of the project. Defects in equipment, materials, or workmanship occurring during this period shall be corrected with new equipment and materials or additional labor at no cost to the Owner.

3.11 SITE VISIT REPORT

- A. Answer in writing each item of discrepancy noted on all site visit reports.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) are hereby made a part of this section, and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems.
- B. The Contractor shall provide all labor, materials, instruments, equipment and service and shall perform all operations required for testing, adjusting, and balancing of systems and related work to obtain the performance of the systems as shown on the drawings and in the specifications.
- C. Definitions:
 - 1. Basic TAB terms used in this section: "Testing, Adjusting and Balancing" of ASHRAE Handbook, latest edition.
 - 2. TAB: Testing, adjusting and balancing. The process of checking and adjusting HVAC systems to meet design objectives.
 - 3. AABA: Associated Air Balance Council.
 - 4. NEBB: National Environmental Balancing Bureau.
 - 5. Hydronic Systems: Includes heating water and chilled water (HVAC).
 - 6. Air Systems: Includes all supply air, return air, exhaust air and outside air systems.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 09 00, INSTRUMENTATION AND CONTROLS FOR HVAC.
- C. Section 23 20 00, HVAC PIPING.
- D. Section 23 30 00, HVAC AIR DISTRIBUTION.
- E. Section 23 34 00, HVAC FANS.
- F. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- G. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.4 QUALITY ASSURANCE

- A. TAB Agency Qualifications: The Contractor shall provide the services of a firm certified by the Associated Air Balancing Council, or the National Environment Balancing Bureau to adjust and balance all heating, ventilating, air conditioning, and exhaust systems. All personnel involved in the execution of the work shall be experienced in the balancing of mechanical systems. The firm shall not be the installer of the systems to be tested and shall be otherwise independent of the project.
- B. Performance Criteria: Work shall be performed in accordance with the approved TAB Agenda.
- C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC (Section Two) or Section II of the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
- D. Guarantee: The AABC or NEBB certified firm shall guarantee that all testing, adjusting and balancing work shall be performed in accordance with NEBB standards and procedures and shall provide evidence of their certification for the Architect/Engineer.

1.5 THE TAB AGENDA

- A. Definition: The proposed TAB procedures and proposed forms, diagrams, and reports for documenting the TAB work.
- B. Preparation: By the TAB Agency for review and approval by the Architect/ Engineer.
- C. The agenda shall include one complete set of the AABC or NEBB publications or, in the case of other TAB organizations, comparable publications to establish an approved systematic and uniform set of procedures.
- D. The Agenda shall also include the following detailed narrative procedures, system diagrams and forms for test results.
 - 1. Specific standard procedures required and proposed for each system. Additional procedures for variable flow systems shall be developed by the TAB Agency and included for review and approval.
 - 2. Specified test forms for recording each TAB procedure and for recording sound and vibration measurements. Additional test forms for any variable flow systems shall be developed by TAB agency and submitted for review and approval.
 - 3. System diagrams for each air system. Diagrams may be single line. In addition to the information recorded for standard AABC or NEBB procedures, report the following information:
 - a. Air Handling Units: Show design and actual CFM (outside air, return air, supply air). Measure and record each mode (minimum OA and 100% OA) where economizer cycle is specified.
 - b. Duct Distribution Systems: Record residual pressures at inlets of volume controlled terminals at ends of system. Show actual pressures at all static pressure control points utilized for constant or variable flow systems.

1.6 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) General Requirements, furnish the following:
 - 1. TAB Agency qualifications, submit name and qualifications of job supervisor.
 - 2. Upon approval of TAB Agency, submit TAB AGENDA for approval.
 - 3. After completion of tests, the Contractor shall submit three copies of complete test reports for approval. Applicable NEBB or AABC reporting forms shall be used. Where test results differ from specified design conditions, indicating a contract deficiency, include explanatory comments in report. The Contractor shall submit final reports prior to requesting the final inspection for the project.
 - 4. Approved copy of report shall be bound in Operations and Maintenance Manuals; see Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The TAB agency shall be responsible for all items or materials necessary for connection of its instrumentation to the ductwork, piping or equipment. Test ports in ducts and plenums shall be installed by the Mechanical Contractor as directed by the TAB agency during the construction of the systems. Test ports shall be identified. Do not proceed with testing, adjusting, and balancing work until systems are complete and operational.

PART 3 - EXECUTION

3.1 GENERAL

- A. The General Contractor shall furnish a complete set of HVAC drawings and specifications to the TAB agency. The agency shall review plans and specifications prior to systems installation and submit a written report indicating deficiencies in the system that would preclude the proper adjusting, balancing, and testing of the system. The HVAC system shall be complete and fully operational with clean air filters and clean pipe strainers prior to system balancing. The TAB agency shall review the installed system for proper installation of testing, adjusting, and balancing equipment and submit a written report indicating system conditions. The Mechanical Contractor shall provide support through factory representatives, equipment mechanics, and control technicians to work with the balancing organization to adjust equipment and controls to obtain design performance.
- B. Coordinate TAB procedures with any phased construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing.

- C. Allow sufficient time in construction schedule for TAB prior to final inspection for the project.
- D. Accomplish TAB in accordance with the Agenda approved by the Architect/Engineer. Put all HVAC systems into full operation and continue operation of the systems during each working day of TAB.
- E. Notify Architect/Engineer 48 hours prior to TAB work.
- F. The TAB agency shall be responsible for adjusting sheaves to acquire required air quantities. If the sheaves require replacement, the sheaves and belts will be replaced by the installer of the equipment.
- G. One week before the final site visit, the balancing organization shall provide the Architect/Engineer with three (3) typed copies of balance reports, in format recommended by NEBB. The report shall contain the following:
 - 1. Project name, location, contractors names, balancing organizations' name, and date.
 - 2. Balancing organizations' certification and individual certified qualifications of persons responsible for supervising and performing the actual work.
 - 3. Brief description of balancing instruments used for this project and their latest calibration performance.
 - 4. Weather conditions at the beginning and end of each day to include; outside dry bulb and wet bulb temperatures, general weather description and cloud cover.
 - 5. System data for each unit:
 - a. Installation data as applicable; mark, location, manufacturer, model, size, arrangement, motor HP, voltage, phase, and full load amps.
 - b. Design quantities and balance readings taken during the balancing operation indicating the quantity measured on the first reading, and the final, balanced, measured quantity for air balance.

3.2 AIR BALANCE

- A. Place all interactive systems in operation with all filters installed and automatic control systems completed and operating. Artificially load air filters by partial blanking or other means to produce air pressure drop midway between the clean and dirty condition. Set/reset room thermostats as necessary to check heating and cooling function, and flow rates for factory set air terminal units and adjust units if not correct.
- B. Balance systems to design ratings. Adjust fan speeds to provide design flows, including system diversities, at actual system pressures. V-belt drives, including fixed pitch requirements, are specified in Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) General Requirements. Coordinate VAV balancing, including supply and return fan volume controls, with Section 23 09 00, Instrumentation and Controls for HVAC. Set supply fan static pressure control as low as practicable and still maintain required pressure at the remote terminal units. The drive motor of each fan shall not be loaded over the corrected full load amperage rating of the motor involved.

- C. Make pitot tube traverses of all trunk lines and major branches when required to determine proper proportioning of air flows. Air flow measuring devices, where installed, may be utilized for this purpose.
- D. Record pressure drop readings across all major systems.
- E. Make flow measurements at each terminal device and each supply, return, or exhaust diffuser. Adjust each air outlet unit within plus or minus 10 percent of design requirements. Adjust grilles and diffusers to minimize drafts in all areas.
- F. Adjust outside air and return air quantities for all systems to within plus or minus 10 percent.
- G. Adjust exhaust systems to CFM requirements. After balance is completed, change variable shims to fixed shims.
- H. Test function of automatic dampers and operation of air terminal units.
- I. Any adjustments necessary to achieve the specified results shall be provided by the Contractor who furnished and installed such equipment under his contractual obligations. Such adjustments may encompass, but are not necessarily restricted to, the changing of pulleys and belts.
- J. Report the air balance readings for the following as further specified in 3.01.G:
 - 1. Air handling equipment - Outdoor air quantity, return air quantity, supply air quantity, fan speed (rpm), static pressure at fan suction and discharge (inches wg.), and actual motor amp and voltage reading.
 - 2. Exhaust fans - Air quantity, fan speed (rpm) and static pressure, actual motor amps and voltage reading.
 - 3. Each air distribution outlet and inlet identified by location and size, air velocity (fpm) and computed air quantity (cfm).
 - 4. Temperature in each room in building and thermostat setting.

3.3 TEMPERATURE CONTROL TEST

- A. After the heating, ventilating and air conditioning systems have been adjusted and balanced completely, a six hour test shall be run on both the heating and cooling cycles, including the economizer cycle, to determine whether the systems are responding to the temperature controls. Thermostat settings, thermostat temperature readings, and an independent temperature measurement at the thermostat shall be recorded at each thermostat. If the tests on both the heating and cooling cycles can not be made together because of the time of the year, the test not made shall be performed later when conditions are acceptable. A supplement to the final report shall be filed when later tests are made.
- B. Test Verification - The TAB agency shall attest by letter that all equipment has been wired and tested to see that the indicated sequence of motor control is established, that all safety controls function properly, that all motor protective devices are sized correctly, and that the systems are operating at the points set on the controls.

- C. Control Setting - During the performance tests, control settings may require adjustment and if so, shall be adjusted to produce the best-balanced system operation. The final setting of each operating and safety control shall be recorded. This shall include but not be limited to thermostats, limit controls, damper position switches, smokestats, firestats, freezestats, aquastats, and other similar items.
- D. Marking of settings - Upon completion of system balancing the settings of adjustment devices including valves and dampers shall be permanently marked. Do not mark room mounted thermostats.

END OF SECTION

SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) General Requirements, are hereby made a part of this section, and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. The work to be performed under this section of the specifications comprises the furnishing of all labor and materials and the completion of all work of this section as shown on the drawings and/or herein specified.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.
- C. In general, the work included under this section consists of, but is not limited to, the following:
 - 1. Field applied insulation for thermal efficiency and condensation control for HVAC and plumbing piping, ductwork and equipment.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 20 00, HVAC PIPING.
- C. Section 23 30 00, HVAC AIR DISTRIBUTION.
- D. Section 23 34 00, HVAC FANS.
- E. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- F. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.4 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) General Requirements, furnish the following:

1. Manufacturer's Literature and Dimension Cuts:

- a. Insulation Materials: Each type used. State surface burning characteristics and thermal properties.
- b. Insulation Facings and Jackets: Each type used. State vapor barrier properties. State that white finish will be furnished for exposed pipe, ductwork, casings, and equipment.
- c. Insulation Accessory Materials: Each type used.
- d. Manufacturer's installation and fitting fabrication instructions for elastomeric unicellular insulation.
- e. Make reference to applicable specification paragraph numbers for coordination.

1.5 DEFINITIONS

- A. Air Conditioned Space: Space directly supplied with cooled air.
- B. Cold: Equipment, ductwork or piping handling media at design temperature of 60 Deg. F. or below.
- C. Hot: Ductwork handling air at design temperature above 60 Deg. F.; equipment or piping handling media above 105 Deg. F.
- D. PCF: Density, pounds per cubic foot.
- E. VOC's: Volatile Organic Compounds
- F. Runout: Branch pipe connection up to one inch nominal size and not over 12 feet in length to a floor mounted or ceiling mounted terminal unit.
- G. Thermal Conductance: Heat flow rate through materials.
 - 1. Flat Surface: BTU per hour per square foot.
 - 2. Pipe or Cylinder: BTU per hour per linear foot.
- H. Thermal Conductivity (k): $(\text{BTU} \cdot \text{in thickness})/(\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F temperature difference})$.
- I. Outside: Open to view beyond the exterior side of walls, above the roof and unexcavated or crawl spaces, above or beneath pier floors, in tunnels or exposed on all sides in trenches connected or not connected to an exterior portion of a building.
- J. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.
- K. Unfinished Spaces: Spaces used for storage or work areas where appearance is not a factor, unexcavated spaces, crawl spaces, etc.
- L. Concealed Spaces: Spaces between a ceiling and floor construction above or between double walls or furred-in areas, pipe and duct shafts, etc.

- M. Exposed: Open to view inside the building. For example, pipe run through a room, and not covered by other construction, is exposed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Building characteristics of insulation materials shall comply with NFPA 90A, pertinent parts of which are noted as follows:
 - 1. Duct coverings, duct linings, vapor barrier facings, tapes, and core materials in panels used in duct systems shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating not higher than 50. If coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when in the final dry state.
 - 2. Duct coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with ASTM C 411 at the temperature to which it is exposed in service. In no case shall the test temperature be below 250 Deg. F.
 - 3. Pipe insulation and coverings shall meet the requirements of 2-3.3.1 and 2-3.3.2 when installed in ducts, plenums, or concealed spaces used as part of the air distribution system.
 - 4. In addition to NFPA, the insulation material shall not transform into a molten flaming liquid during combustion as characterized by some polyethylenes.
- B. Test Methods: ASTM E 84, UL 723, or NFPA 255.
- C. Insulation shall be Johns Manville, Owens Corning, Pittsburg Corning, or Armacell. Trade names are used herein, unless indicated otherwise, to establish a standard of quality.
- D. Specified k factors are at 75 Deg. F. mean temperature unless stated otherwise. Where optional insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For a flat surface, thermal conductance equal thermal conductivity (k) divided by the thickness of the insulation. For runout insulation and condensation control insulation, no thickness adjustment need be made.
- E. All materials shall be compatible and suitable for service temperature and shall not contribute to corrosion or otherwise attack surfaces to which applied in either the wet or dry state.
- F. Underwriters' Laboratories, Inc. label or listing, or satisfactory certified test report from an approved testing laboratory will be required to show that surface burning characteristics for materials to be used do not exceed specified ratings.
- G. All sealants and adhesives must comply with all applicable South Coast Air Quality Management District (SCAQMD) VOC limits including but not limited to Rule #1168. All mastics and coatings must comply with all applicable Green Seal GS-11 VOC limits.

2.2 FACINGS AND JACKETS

A. Fed. Spec. HH-B-100 for Vapor Barrier Types I and II:

1. Puncture Test Method: ASTM D 781.
2. Type I, Low Vapor Transmission (0.02 Perm Rating), Beach Puncture 50 Units: For insulating facing on exposed ductwork, casings, and equipment, and for all pipe insulation jackets. Facings and jackets shall be white all service type (ASJ) suitable for painting without priming.
3. Type II, Medium Vapor Transmission, Beach Puncture 25 Units: Foil-Scrim-Kraft (FSK) type for concealed ductwork and equipment.
4. Factory composite materials may be used provided they have been tested and certified by the manufacturer to meet Beach puncture units specified above.
5. Fire and smoke treatment of jackets and facings shall be permanent. The use of water soluble treatments is not acceptable.
6. Pipe insulation jackets shall have 1-1/2 inch minimum lap at longitudinal joints and not less than 3-inch butt strips at end joints. Facing on board, blanket and block insulation shall have 2-inch laps or 3-inch minimum butt strips. Butt strip material shall be the same as the jacket or facing. Laps and butt strips may be self-sealing type with factory applied pressure sensitive adhesive.

2.3 MINERAL FIBER INSULATION

A. Owens-Corning Faced Duct Wrap Fiberglass Insulation - FRK Type 100, ASTM C 553-92 (Blanket, Flexible), Density 1 pcf, $k = 0.31$, for temperatures up to 250 Deg. F.

1. Concealed supply air ductwork within building's thermal envelope shall be 1-1/2 inch thick insulation.
2. Concealed return air ductwork within building's thermal envelope need not be insulated.
3. Concealed exhaust air ductwork within building's thermal envelope within 10 feet of connection to outdoors shall be 1-1/2 inch thick insulation.
4. Concealed transfer ducts with acoustic lining within the building's thermal envelope need not be insulated.

B. Owens-Corning 705 Rigid Board Fiberglass Insulation, ASTM 612, 6 pcf density, with white laminated kraft-aluminum foil reinforced all-service vapor barrier facing.

1. Exposed AHU-1 outside air ductwork in M201 MECHANICAL including louver plenum box shall be 2-inch thick insulation.
2. Exposed AHU-1 supply air ductwork IN M201 MECHANICAL shall be 1-1/2 inch thick insulation.
3. Exposed AHU-1 return and exhaust ductwork in M201 MECHANICAL need not be insulated.

C. Molded pipe fitting covering: Fed. Spec. HH-I-558, Form E. Class 16, $k = 0.26$, for temperatures up to 370 Deg. F.

- D. Insulation thickness and type for various piping systems shall be as indicated in the following table (Pipe Size/Insulation Thickness).

PIPE SIZE/INSULATION THICKNESS(1)							
System	Temp. Range (°F)	Less than 1"	1" to 1-1/4"	1-1/2" to 3"	4" to 6"	8" & Up	Ins. Type (4)
Condensate Drain	45-75	0.5	0.5	1.0	1.0	1.0	A,B
Refrig.	Below 40 (2)	1.0	1.0	1.5	1.5	1.5	B

NOTES:

- (1) Minimum thickness for insulation listed in preceding table is based on Thermal Conductivity, 'k' not exceeding 0.27 Btu per inch/hr. x sq. ft. x Deg. F. based on Mean Temperature of 75 Deg. F. Insulation with greater Thermal Conductivity shall have increased thickness to provide same performance characteristics as specified.
- (2) A - Fiberglass type insulation; B - Elastomeric type insulation.

2.4 ELASTOMERIC INSULATION

- A. Armstrong Armaflex II Pipe Insulation, Fed. Spec. HH-I-573 and HH-I-1751/2, k = 0.27, flame spread not over 25, smoke developed not over 50 (1/2-inch thick test material), for temperatures from minus 40 Deg. F. to 211 Deg. F. No jacket required.

2.5 CELLULAR GLASS INSULATION

- A. Pittsburgh Corning Foamglas Insulation, ASTM C 552, Type II, class 2, 8.5 pcf, closed cell rigid type.

2.6 ACCESSORY MATERIALS

- A. Adhesives, Mastics, Cement:

1. Mil. Spec. MIL-A-3316B, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
2. Mil. Spec. MIL-A-3316B, Class 2: Adhesive for laps for adhering insulation to metal surfaces.
3. Mil. Spec. MIL-A-24179A, Type II, Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
4. Mil. Spec. MIL-B-19565B, Type 1 or Type II and be listed on Qualified Products Database (QPD): Vapor barrier compound for outdoor use.
5. Fed. Spec. SS-C-160A, Type IIIB, (ASTM C 449): Mineral fiber hydraulic-setting thermal insulating and finishing cement.
6. Other: Insulation manufacturer's published recommendations.

B. Mechanical Fasteners:

1. Pins, Anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
2. Staples: Outward clinching monel or stainless steel.
3. Wire: 18 gage soft annealed galvanized, or 14 gage copper clad steel or nickel copper alloy.
4. Bands: 3/4-inch nominal width, brass, aluminum or stainless steel.

C. Reinforcement and Finishes:

1. Glass Fabric, Open Weave: ASTM D 1668, Type III (resin treated) and Type 1 (asphalt treated).
2. Glass Fiber Fitting Tape: Mil. Spec. MIL-C-20070, Type II, Class 1.
3. Tape for Flexible Unicellular Insulation: Scotch No. 472, Nashua PE-12, or approved equal recommended by the insulation manufacturer.
4. PVC Fitting Cover: Fed. Spec. L-P-535D, Composition A, Type II, Grade GU, with Form B mineral fiber insert, for media temperature 45 Deg. F. to 250 Deg. F. Below 45 Deg. F. and above 250 Deg. F., provide double layer insert. Provide color matching, vapor barrier, pressure sensitive tape.

D. Firestopping Material: Refer to Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).

PART 3 - EXECUTION

3.1 GENERAL

- A. Required pressure tests of joints and connections shall be completed before application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale, and rust removed.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use necessary means to protect his work and materials.
- C. Except for specific exceptions, insulate entire specified equipment, piping, and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers (NFPA 90A). Vapor barriers shall be continuous and uninterrupted throughout systems with operating temperature 60 Deg. F. and below. Lap and seal vapor barrier over ends

and exposed edges of insulation. Anchors, supports, and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of six inches.

- E. On cold systems, vapor barrier performance is extremely important. Particular care must be given to vapor sealing the fitting cover or finish to the insulation vapor barrier. All penetrations of the jacket and exposed ends of insulation must be sealed with vapor barrier mastic. All valve stems must be sealed with caulking which allows free movement of the stem but provides a seal against moisture incursion.
- F. HVAC Work Not To Be Insulated:
 - 1. Internally insulated ductwork and air handling units.
 - 2. Factory insulated supply air diffusers.
- G. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastics and coatings at the manufacturer's recommended minimum coverage.

3.2 INSTALLATION

- A. Flexible Mineral Fiber Blanket:
 - 1. Adhere insulation to metal with 4-inch wide strips of insulation bonding adhesive at 8 inches on center. Additionally secure insulation to bottom of ducts exceeding 24 inches in width with pins welded or adhered 18 inches on centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations with vapor barrier mastic. Sagging duct insulation will not be acceptable.
 - 2. Supply air ductwork to be insulated includes main and branch ducts from fan discharge to room supply outlets and the bodies of ceiling outlets to prevent condensation. To prevent condensation, insulate trapeze type supports and angle iron hangers for flat oval ducts.
- B. Molded Mineral Fiber Pipe and Tubing Covering:
 - 1. Fit insulation to pipe aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations with vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports.
 - 2. Fittings, Flange and Valve Insulation:
 - a. Fiberglass Pipe insulation shall be installed with joints butted firmly together. Valves and devices requiring access shall be insulation with mitered sections of insulation equal in thermal resistance and thickness to the adjoining insulation. Fittings shall be covered with Schuller "Zeston" type, pre-molded PVC fitting covers. Jackets on pipe insulation shall be stapled using outward clinching type staples spaced 3" apart at least 1/4" from the lap edge on systems operating at 80 Deg. F. and above; below 80 Deg. F. the laps are to

be vapor sealed using self-sealing lap, lap seal gun, or adhesive. All insulation elbows, fittings, flanges, joints, laps, voids, punctures, and end tapers shall be sealed with two coats of Foster Vapor Out 30-33 or Childers Chil Out CP-33 vapor barrier mastic and reinforcing mesh (total 35 mils or 0.9 mm dry film thickness) regardless of service and before Zeston covers are applied.

- b. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least two inches.

C. Elastomeric Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions.
2. Pipe and Tubing Insulation:
 - a. Use proper size material. Do not stretch or strain insulation.
 - b. To avoid undue compression of insulation, provide inserts at supports as recommended by the insulation manufacturer. Insulation shields are provided under Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
 - c. Elastomeric insulation shall be slipped on the pipe prior to connection wherever possible. Pipe leak tests shall be performed prior to the insulation of fittings. Where the slip-on technique is not possible longitudinal slit insulation shall be snapped on the pipe. All seams, voids, and butt joints shall be sealed with a Foster 85-75 or Childers CP-82 vapor barrier adhesive or taped with 1-1/2 inch wide 3M #471 tape.
 - d. Fittings and valves shall be insulated with mitered sections of insulation. All joints shall be secured and sealed with vapor barrier adhesive. Approved factory-made fittings such as F & D Mfg. and Supply Co. may be used.
3. On exterior refrigerant suction piping, provide two coats of Armstrong Armaflex Finish (vinyl lacquer) or Foster 30-64 on the insulation.

D. Rigid Mineral Fiber Board: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from edge of boards and spaced not more than 18-inch centers and secured with washers and clips. Spot-weld anchor pins or attach with a Foster 85-60 or Childers CP-127 adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Where vapor barrier is specified, all joints, breaks, seams, punctures, and voids shall be filled with vapor barrier mastic and covered with vapor seal material identical to that surrounding. Neatly bevel insulation around name plates and access plates and doors. Each pin or anchor shall be capable of supporting a 20-pound load. Protruding ends of clips shall be cut off flush after clips are secured and sealed with aluminum backed pressure sensitive tape and coated with vapor barrier mastic.

E. Metal Jackets: Provide metal jackets on piping insulation in outdoor locations or where otherwise indicated. Metal jackets need not be installed for elastomeric insulation unless noted otherwise. Metal jackets shall have side and end laps at least 2 inches wide with the cut edge of the side lap turned under one inch to provide a smooth edge. Place laps to shed water. Seal laps on cold piping with Foster 95-44 or Childers CP-76 metal

jacketing sealant. Secure jackets in place with aluminum or stainless steel band and screws. Space fasteners as recommended by the jacket manufacturer. Where pipes penetrate exterior walls or roof, continue the increased thickness required for piping exposed to weather and the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall or roof.

- F. Exterior Duct: Exterior supply and return ductwork associated with RTU-1 shall be insulated with 2" thick fiberglass rigid type duct insulation with a factory-applied facing of foil-scrim-kraft paper jacket effectively vapor sealed. Seal all surfaces watertight with Foster Vapor-Safe heavy-duty mastic 30-90, Childers Chill Low CP-38 or approved equal as follows:
1. Apply tack coat of vapor barrier mastic to clean surfaces at two (2) gallons per 100 square feet.
 2. Embed wet tack with Foster MAST-A-FAB, Childers Chil Glas #10 or equal white membrane. Smooth membrane to avoid wrinkles and overlap all seams minimum 2 inches.
 3. Apply finish coat of vapor barrier mastic within 1/2 hour of tack coat at four gallons per 100 square feet.
 4. Total dry film thickness shall be minimum 57 mils (1.4 mm).
 5. Paint with two coats of exterior grade latex of color as selected by Architect.

END OF SECTION

SECTION 230900
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) are hereby made a part of this section and the Contractor is cautioned to read Section 23 00 00 carefully, especially paragraph 2.3 Motors, Control and Electrical Wiring as items of work applicable to this section.

1.2 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)
- B. Section 23 20 00, HVAC PIPING
- C. Section 23 34 00, HVAC FANS
- D. Section 23 30 00, HVAC AIR DISTRIBUTION
- E. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC
- F. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT
- G. Section 23 82 00. CONVECTION HEATING AND COOLING UNITS

1.3 COORDINATION OF SPECIFICATIONS

- A. Motorized Dampers: Furnish Damper per 23 30 00; Furnish Actuator per 23 09 00; Install Damper per 23 30 00; Install Actuator per 23 09 00.
- B. Temperature Control Wiring: Furnish and install per 23 00 00 and 23 09 00.
- C. Wall Rough-in for Controls: Furnish and install per 23 00 00 and 23 09 00.
- D. Central Controls Panel Connections for Power, Modem and Fire Alarm: Furnish and install per Electrical Specifications. Power connections for all new Building Automation System (BAS) control panels shall be connected to emergency electrical circuits designated on the Electrical Drawings. Circuit breakers will be provided as shown on Electrical Panel Schedule.
- E. NOTE: The technical specifications are arranged for convenience and such arrangement shall not operate to make the Architect/Engineer an arbiter in establishing the limits of any subcontract or trade.

1.4 DESCRIPTION OF WORK

- A. Operator Interface
- B. System Controllers
- C. Unit Controllers
- D. Input/Output Interface
- E. Software
- F. Auxiliary Control Devices
- G. Wiring
- H. Sequence of Operations
- I. Points Lists

1.5 GENERAL INSTRUCTIONS

- A. The new BAS shall be required to communicate with the existing head end computer located at the Facilities Building.
- B. The Building Control System as specified herein shall be provided in its entirety by one manufacturer. The BAS/ATC Contractor shall base this Bid on the system as specified, the Sequence of Operations and the Points List.
- C. Installation shall be by qualified employees or representatives of the temperature control manufacturer. Indirect temperature control work by independent contractors will not be accepted. The temperature control manufacturer shall be Trane Controls. The system shall be connected via BACNET over IP, to the head-end of the existing on site BAS.
- D. Control system manufacturer shall prove to Owner's satisfaction that control system is compatible and can integrate with, via BACNET protocol to the control system.

1.6 REFERENCE STANDARDS

- A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
 - 1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
 - 2. Uniform Building Code (UBC), including local amendments.
 - 3. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

4. National Electrical Code (NEC).
5. FCC Part 15, Subpart J, Class A
6. EMC Directive 89/336/EEC (European CE Mark)
7. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences

- B. City, county, state, and federal regulations and codes in effect as of contract date.
- C. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.7 SCOPE

- A. The BAS/ATC system shall be supplied and installed completely under the BAS/ATC Contract. Control components shall be mounted and wired by the BAS/ATC Contractor.
- B. The engineering, installation, calibration, software programming and checkout necessary for complete and fully operational BAS/ATC systems, as specified hereafter, shall be provided by the BAS/ATC Contractor.
- C. It shall be the responsibility of the BAS/ATC Contractor to fully coordinate with all equipment suppliers to provide a complete functional control system as described in Section 3.4, Sequences of Operations.
- D. Contractor shall be responsible for maintaining proper control for all areas that are to be occupied during the installation of the new work.

1.8 SUBMITTALS

- A. The following data/information shall be submitted for approval:
 1. Complete sequences of operation and points list.
 2. Control system CAD generated drawings including all pertinent data to provide a functional operating system, as well as point to point wiring diagrams.
 3. Damper schedules showing all damper sizes and configuration for motorized dampers.
 4. Data sheets for all hardware and software control components.
 5. A description of the installation materials including conduit, wire, flex, etc.
 6. Computer panel locations.
 7. Provide as part of the submittal two copies of all data and control drawings.

1.9 QUALIFICATIONS

- A. The BAS Contractor shall be Trane.

1.10 WARRANTY

- A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.
- B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday.
- C. This warranty shall apply equally to both hardware and software.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The building automation system shall include but not be limited to the following components:
 - 1. The Operator Interface shall consist of hardware and software that allows full user monitoring and adjustment of system parameters.
 - 2. System Application Controllers shall manage the Energy and Building Management capabilities of the automation system as well as facilitate network communications to the existing, county wide head end for central monitoring.
 - 3. Application Specific Controllers shall provide distributed, pre-engineered control specific to the mechanical equipment specified.
 - 4. Custom Application Controllers with distributed custom programming capability shall provide control for non-standard control sequences.
 - 5. The Data Communications capability shall allow data to be shared between the various controllers in the architecture.
 - 6. The system software shall include system software for the global application functions, application software for distributed controllers, and operator interface software.
 - 7. End devices such as sensors, actuators, dampers, valves and relays.
- B. The failure of any single component shall not interrupt the control strategies of other operational devices. System expansion shall be through the addition of end devices, controllers, and other devices described in this specification.
- C. Communication: All System Application Controllers and the Operator Workstation shall communicate via ETHERNET and shall reside on the owner's existing ETHERNET IT wide Area Network, operating at a minimum speed of 10/100 Mb/sec.

2.2 SYSTEM APPLICATION CONTROLLERS

- A. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based System Application Controllers to manage the global strategies described in the Application software section. The System Application

Controllers shall be the latest generation product line utilizing open protocol communication. Communication shall use BACNET protocol only.

- B. The operating system of the System Application Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms. Data shall automatically be shared between System Application Controllers when they are networked together.
- C. The database and custom programming routines of remote System Application Controllers shall be editable from a single operator station.
- D. The System Application Controllers shall have the capability of being remotely monitored over telephone modem. Additional capabilities shall include automatically dialing out alarms, gathering alarms, reports and logs, programming and downloading databases.

2.3 APPLICATION SPECIFIC CONTROLLERS

- A. Application Specific Controllers shall be standalone, microprocessor based Direct Digital Controllers with sufficient memory to handle its operating system, database and programming requirements. The controller shall be fully tested upon installation to ensure that it is properly matched to the equipment it is controlling. The System Application Controllers shall be the latest generation product line utilizing open protocol communication. Communication shall use BACNET or N2 Open protocols only. The controller shall communicate with other devices on the communication network and be fully integrated with the other system components.

2.4 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through Application Specific Controllers. Slave devices are not acceptable.
- B. All status points shown on the Point List shall be positive proof current sensing binary switches. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide a 0 or 10 VDC signal as required to provide proper control of the output device.

2.5 SYSTEM APPLICATION CONTROLLER SOFTWARE

- A. System Security: User access shall be secured using individual security passwords for a minimum of 500 users. Passwords shall have at least three levels of user access with data entry restrictions being assignable by password.
- B. Alarms: The Building Automation System shall provide alarm points over network IP for:
 - 1. Remote equipment failure
 - 2. Equipment run time
 - 3. Number of start/stops
 - 4. Program failure
 - 5. Card failure
 - 6. Sensor failure

- C. When an alarm state is detected, the alarm shall automatically be stored and the user notified by sending the alarm message to the existing head end workstation.
- D. Controllers shall automatically communicate with the existing operator workstations to report alarms, and upload historical data and reports. In the event that the controller is unable to connect with the workstation, it shall continue to attempt communication on a predetermined interval until communication is successful.

2.6 ENERGY MANAGEMENT SOFTWARE

- A. The following Energy Management capabilities shall be furnished standard as part of the building Automation System.
 - 1. Scheduling: The scheduling program shall have a minimum of 32 named master schedules. Each master schedule shall have a minimum of eight day schedules (seven plus holidays).
 - 2. Optimum Start/Stop: An optimum start/stop program shall determine the required equipment start/stop timing by applying inside/outside temperature information to the user's time of day schedule.
 - 3. Morning warm-up/cool-down: A scheduling program allowing operation of equipment to bring room temperatures to setpoint with the outdoor air dampers closed.

2.7 BUILDING MANAGEMENT SOFTWARE

- A. The following Building Management capabilities shall be furnished as part of the Building Automation System.
 - 1. Timed Override: A timed override program shall be provided to enable the building operator to set up devices or groups of device to be temporarily turned on for defined period of time based on binary inputs, analog inputs, or CRT inputs.
 - 2. Direct Digital Control: The Direct Digital Control program shall allow modulating control of remote devices based on sensed data. Standard control strategies shall include proportional, proportional plus integral, and proportional plus integral plus derivative control.
 - 3. Custom Programming Language: A custom control language capability shall be provided to allow the operator to create real time, equation based, customer control routines. Equation operations shall include math functions such as addition, subtraction, multiplication, division, square root, minimum, maximum and average. Logical functions such as greater than, less than, equal to, not equal to, less than or equal to, greater than or equal to, variable timing and delays shall also be allowed.
 - 4. Reports and Logs: The system shall include the capability to store, review and print the following reports and logs. In addition, if a PC interface is specified, these reports shall be saved.
 - 5. Custom Report Capability: The building operator shall be provided with a simple method of creating customer reports.

6. Anti-Recycle Timer Protection: A software program shall be provided to allow each individual piece of HVAC equipment to be individually programmable with "minimum on" and "minimum off" timers to protect HVAC equipment from rapid cycling due to system or operator error.
7. Diagnostics: A system self-test shall be provided. On self-test initiation, panels failing to respond shall be identified.
8. Custom Programming Requirements: A user friendly custom DDC programming utility shall be provided to allow the building operator to tailor the system to meet individual needs and respond to changing building requirements. The building operator shall be able to create custom DDC routines using analog and binary point values, alarm states, constants and shared variables to perform calculations. The results of these calculations shall be used to perform analog control, binary control, DDC loop enable/disable, and other control functions. The building operator shall be able to download these routines to the System or Custom Application controllers via direct connect.

2.8 AUXILIARY CONTROL DEVICES

A. Damper Actuators:

1. The building automation system supplier shall provide all automatic control damper actuators not specified to be supplied integral to the HVAC equipment.
2. Damper operators shall be electric, spring return, and shall be properly sized so as to stroke the damper smoothly and efficiently throughout its range. Provide permanent split-capacitor or shaded pole type motors with sealed gear trains. Provide low voltage type (24 VAC) or 115V when directly interlocked with 115V equipment. Actuator response shall be linear in response to sensed load.

B. Temperature sensors:

1. Temperature sensors shall be resistance temperature detector (RTD) or thermistor as dictated by the requirements of this specification.
2. Duct sensors shall be rigid or true averaging as specified in the Sequence of Operation. Averaging sensors shall be a minimum of 5 feet in length.
3. Space sensors shall be decorative thermostat type with limited adjustable setpoints for heating and cooling, timed override switch and service port. The setpoints for heating and cooling shall be manually adjustable and software limited to control the amount of adjustment to +3 degrees (program adjustable). The timed override switch with indicator shall override the unoccupied mode for a limited time period (program adjustable). The built-in service port shall allow connection of a portable computer to monitor, troubleshoot, and adjust the HVAC system.
4. Accuracies shall be +/- 1 Deg. F. for standard applications. Where high accuracy is required, accuracies shall be +/- .2 Deg. F.
5. Where located next to CO2 or Humidity sensors, combination sensors may be provided.

C. Differential pressure switches: Differential pressure switches shall be furnished as indicated for status purposes. Provide single pole double throw switch with fully adjustable differential pressure settings.

D. Static Pressure Sensors:

1. Static pressure sensors shall be differential pressure type. The sensor range shall be closely matched to the system static pressure, -.5 to .5 inches, 0 to 2.5 inches.
2. Sensor accuracy shall be plus or minus 5% of the sensing range.

E. High limit thermostats: High limit thermostats shall be manual reset type set at 120 Deg. F.

F. Low limit thermostats:

1. Safety low limit thermostats shall be vapor pressure type with a 20 foot minimum element. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

G. Humidity sensors:

1. Humidity sensors shall be capacitance or bulk polymer resistance type.
2. Duct and room sensors shall have a sensing range of 20 to 80% with accuracy of +5% R.H. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20 to 95% R.H. It shall be suitable for ambient conditions of -40 to 170 Deg. F.

H. CO2 sensors:

1. Sensors shall utilize silicon-based non-dispersive infrared to detect CO2.
2. Range shall be 0 to 2000 ppm with an accuracy of +/- 30 ppm CO2 + 3% of reading.
3. Operating range shall be from 32 to 122 deg. F and 0-85% RH.

2.9 WIRING

- A. Provide wiring and miscellaneous appurtenances for a complete system in accordance to specification Section 23 00 00. Wiring shall be concealed in conduit in mechanical rooms and plenum rated cabling shall be used where accessible.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. All electrical work performed in the installation of the BAS/ATC system as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. Install wiring in accordance to specification Section 23 00 00.
- B. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Where conductors are concealed, cable rated for use in return air plenums shall be used without EMT or conduit.

- C. The ATC Contractor shall provide coordination to assist the Testing and Balancing Contractor.

3.2 OWNER TRAINING

- A. The BAS/ATC contractor shall provide two copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control and Building Automation System supplied. This contractor shall instruct the owner's designated representatives in these procedures during the startup and test period. The duration of the instruction period shall be no less than 24 hours, during normal working hours. Provide follow-up eight (8) hour instruction period to be scheduled six (6) months after initial training.

3.3 SEQUENCE OF OPERATIONS

- A. Variable Volume Multi-Zone Split System Air Conditioning Unit (AHU-1 / CU-1)

1. Occupied Mode: The supply fan shall operate continuously.
 - a. Cooling: On a call for cooling, the BAS shall modulate open the outside air damper to maintain discharge air setpoint per a differential enthalpy economizer with fixed dry-bulb temperature. On a continued call for cooling, the BAS shall energize the DX cooling in stages to maintain discharge air temperature setpoint of 55 deg F (adjustable). The discharge air setpoint shall be reset by the variable air volume terminal box calling for the most cooling at its maximum primary air flow setpoint.
 - b. Economizer: An enthalpy economizer shall compare indoor and outdoor enthalpy or the outdoor air and return air temperature and modulate the unit outdoor air damper and return air damper during the cooling cycle to provide up to 100% outdoor air for free cooling. Economizer shall shut off when outdoor enthalpy exceeds return air enthalpy or when outdoor air temperature exceeds 75 deg. F.
 - c. Dehumidification Control: Space humidity shall be measured by a return air duct-mounted humidistat. Upon a call for dehumidification (setpoint adjustable), the unit cooling discharge air reset control shall be over-ridden to lower the discharge air temperature to provide dehumidification of the supply air to satisfy the humidity setpoint. Variable air volume terminal boxes shall modulate and provide reheat to prevent over-cooling of the spaces.
 - d. Heating: On a call for heating, the BAS shall modulate the outside air damper to minimum and also stage the electric heating coil to maintain discharge air temperature setpoint of 65 deg F. The discharge air temperature setpoint shall be reset by the variable air volume terminal box calling for the least amount of heat at its minimum primary air flow setpoint. Coil shall stop heat output whenever mechanical cooling, including economizer operation is active.
 - e. Outdoor Air: Outdoor Air: In occupied mode, the minimum outdoor air set point shall be the "DCV OA CFM". When signaled by a VAV box with demand ventilation control, the minimum outdoor air shall increase to the "OA CFM" setpoint. As the supply fan speed varies, the outdoor air damper shall

modulate in order to continuously provide the quantity of outside air listed in the equipment schedules (minimum outdoor air control). The outdoor air damper shall also modulate open in the economizer cycle and shall modulate according to space CO2 level as described in the variable air volume terminal sequence of control. Both economizer control and CO2 control damper modulation shall override minimum outdoor air control damper modulation. Economizer control damper modulation shall override CO2 control damper modulation. During CO2 control operation, the outside air shall not exceed the maximum outside air quantity scheduled in the equipment schedules.

- f. VAV: The relief damper associated with the air handling unit shall operate as required to maintain building differential pressure setpoint of +0.05 in. H2O (adjustable). A differential pressure controller shall compare the indoor air pressure with the outdoor ambient atmospheric pressure. The duct static pressure sensor shall modulate the variable speed drive (VFD) of the supply air fan and exhaust fan to maintain a constant static pressure. The static pressure setpoint shall automatically be reset to conserve fan energy based upon the minimum duct static pressure required to satisfy the 'critical' variable volume box.
2. Unoccupied Mode: When the unit is in unoccupied mode, the outdoor air damper and relief air damper shall be closed and the supply air fan shall cycle to maintain space temperature of at least 10 Deg. F. below the occupied heating setpoint, and 10 Deg. F. above the cooling setpoint. On a manual call for override from the temperature sensor override button, the system shall return to the occupied mode of operation for a set period of time.
 3. Morning Warm-up/Cool Down Mode: The BAS shall optimally start the unit and modulate the heating or cooling coils to reach occupied setpoint by scheduled occupied time. The outside air damper shall be closed. The unit shall signal all variable air volume terminal boxes to full flow until the morning warmup/cool down setpoint is reached and the unit returns to occupied mode.
 4. Safeties: Safeties: A duct smoke detector shall be provided in the return duct upstream of the air filters. On detection of products of combustion, the duct smoke detectors shall stop the unit supply and exhaust fans and alarm the BAS and the Fire Alarm System.
 5. Airflow measurement probes shall be provided across the outside air intake damper for flow measurement. All electronics and controls for airflow measurement shall be provided by the unit manufacturer. Airflow measurement probes shall be Ebtron (or equal).

B. Variable Volume Multi-Zone Packaged Rooftop Air Conditioning Unit (RTU-1)

1. Occupied Mode: The supply fan shall operate continuously.
 - a. Cooling: On a call for cooling, the BAS shall modulate open the outside air damper to maintain discharge air setpoint per a differential enthalpy economizer with fixed dry-bulb temperature. On a continued call for cooling, the BAS shall energize the DX cooling in stages to maintain discharge air temperature setpoint of 55 deg F (adjustable). The discharge air setpoint shall be reset by the variable air volume terminal box calling for the most cooling at its maximum primary air flow setpoint.
 - b. Economizer: An enthalpy economizer shall compare indoor and outdoor enthalpy or the outdoor air and return air temperature and modulate the unit outdoor air damper and return air damper during the cooling cycle to provide up to 100% outdoor air for free cooling. Economizer shall shut off when outdoor enthalpy exceeds return air enthalpy or when outdoor air temperature exceeds 75 deg. F.
 - c. Dehumidification Control: Space humidity shall be measured by a return air duct-mounted humidistat. Upon a call for dehumidification (setpoint adjustable), the unit cooling discharge air reset control shall be over-ridden to lower the discharge air temperature to provide dehumidification of the supply air to satisfy the humidity setpoint. Variable air volume terminal boxes shall modulate and provide reheat to prevent over-cooling of the spaces.
 - d. Heating: On a call for heating, the BAS shall modulate the outside air damper to minimum and also stage the electric heating coil to maintain discharge air temperature setpoint of 65 deg F. The discharge air temperature setpoint shall be reset by the variable air volume terminal box calling for the least amount of heat at its minimum primary air flow setpoint. Coil shall stop heat output whenever mechanical cooling, including economizer operation is active.
 - e. Outdoor Air: Outdoor Air: In occupied mode, the minimum outdoor air set point shall be the "DCV OA CFM". When signaled by a VAV box with demand ventilation control, the minimum outdoor air shall increase to the "OA CFM" setpoint. As the supply fan speed varies, the outdoor air damper shall modulate in order to continuously provide the quantity of outside air listed in the equipment schedules (minimum outdoor air control). The outdoor air damper shall also modulate open in the economizer cycle and shall modulate according to space CO2 level as described in the variable air volume terminal sequence of control. Both economizer control and CO2 control damper modulation shall override minimum outdoor air control damper modulation. Economizer control damper modulation shall override CO2 control damper modulation. During CO2 control operation, the outside air shall not exceed the maximum outside air quantity scheduled in the equipment schedules.
 - f. VAV: The exhaust blower shall operate at a constant speed set point during operation. The controller shall proportionally modulate the exhaust blower based upon the outdoor air damper position. A differential pressure controller shall compare the indoor air pressure with the outdoor ambient atmospheric pressure. The duct static pressure sensor registering the lowest pressure shall modulate the variable speed drive (VFD) of the supply air fan and

exhaust fan to maintain a constant static pressure. The static pressure setpoint shall automatically be reset to conserve fan energy based upon the minimum duct static pressure required to satisfy the 'critical' variable volume box.

2. Unoccupied Mode: When the unit is in unoccupied mode, the outdoor air damper and relief air damper shall be closed and the supply air fan shall cycle to maintain space temperature of at least 10 Deg. F. below the occupied heating setpoint, and 10 Deg. F. above the cooling setpoint. On a manual call for override from the temperature sensor override button, the system shall return to the occupied mode of operation for a set period of time.
3. Morning Warm-up/Cool Down Mode: The BAS shall optimally start the unit and modulate the heating or cooling coils to reach occupied setpoint by scheduled occupied time. The outside air damper shall be closed. The unit shall signal all variable air volume terminal boxes to full flow until the morning warmup/cool down setpoint is reached and the unit returns to occupied mode.
4. Safeties: Safeties: A duct smoke detector shall be provided in the return duct upstream of the air filters. On detection of products of combustion, the duct smoke detectors shall stop the unit supply and exhaust fans and alarm the BAS and the Fire Alarm System.
5. Airflow measurement probes shall be provided across the outside air intake damper for flow measurement. All electronics and controls for airflow measurement shall be provided by the unit manufacturer. Airflow measurement probes shall be Ebtron (or equal).

C. Variable Air Volume Terminals (VAV-):

1. Occupied Mode: BAS shall modulate air damper and heating coil to maintain a zone temperature of 75 Deg. F. while the associated air handling unit is in cooling mode, and a zone temperature of 70 Deg. F. while the associated air handling unit is in heating mode.
 - a. Cooling: On a call for cooling, the BAS shall modulate the air damper between its minimum and maximum setting to maintain a zone temperature of 75 Deg. F. While in cooling mode and there is a call for heating, the damper shall move to the minimum position before opening the heating coil.
 - b. Heating: BAS shall modulate the air damper and SCR heating coil to maintain a zone temperature of 70 Deg. F. On a call for heating, the damper shall move to the minimum position before opening the heating coil. If a zone temperature of 70 Deg F. cannot be maintained at minimum airflow, the damper shall move to the maximum heating setpoint.
 - c. Unit thermostat shall provide a deadband of at least 5 Deg. F. within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. If the air damper operates at maximum air flow and is unable to maintain heating or cooling setpoint, then the BAS shall reset the associated air handling unit supply air temperature.
2. Unoccupied Mode: On a call for heating from the zone temperature sensor, the BAS shall modulate open the air damper from the minimum to the maximum setting to maintain night temperature setback of 85 Deg. F in cooling and 60 Deg. F in

heating (adjustable). If the air damper operates at maximum air flow and is unable to maintain the night temperature setback, then the BAS shall reset up the associated air handling unit supply air temperature. On a manual call for override from the space override button, the system shall return to the occupied mode of operation for a set period of time.

3. Morning Warm-Up/Cool-Down: On a signal from its associated unit, the air damper shall open to its maximum setting until the morning warm-up/cool down setpoint is reached for its respective zone temperature sensor. If the air damper operates at maximum air flow and is unable to reach the morning setpoint, then the BAS shall reset the associated air handling unit supply air temperature.
4. Carbon Dioxide Control: For units with a CO2 sensor, the terminal damper shall be located at the "DCV MIN" position. When the CO2 sensor detects a rise in space CO2 levels above a 730 ppm setpoint, the VAV terminal shall open the damper to the "COOLING MIN" setpoint. If the CO2 setpoint is not satisfied, the VAV shall signal the AHU and the AHU minimum setpoint shall switch from "DCV OA CFM" to "OA MIN CFM". If CO2 levels remain above setpoint, the VAV terminal shall signal the BAS to increase the outdoor air at the associated air handling unit, until setpoint is reached or the air handling unit is at maximum.

D. Electric Heaters :

1. ECH-1: Unit shall be controlled by a unit-mounted thermostat. When the unit is energized, the unit-mounted thermostat shall cycle the unit fan and control the electric heat to maintain the space temperature. Thermostat shall be set to 60 deg F (adjustable).
2. EUH-1: Unit shall be controlled by a wall-mounted thermostat. When the unit is energized, the thermostat shall cycle the unit fan and control the electric heat to maintain the space temperature. Thermostat shall be set to 60 deg F (adjustable).
3. EF-1: Unit shall be controlled by a temperature sensor located in the return duct near the return grille. The unit shall energize the fan and heating electric heat to maintain a minimum return air temperature of 60 deg F (adjustable).

F. Exhaust Fans:

1. EF-1, EF-2, & EF-5: Fan shall run continuously during building occupied hours.
2. EF-3: Fan shall run continuously during building occupied hours. Fan shall be interlocked with RTU-1 such that the fan will also operate when RTU is scheduled to run outside of standard occupied hours such as nights and weekends.
2. EF-4: Fan shall be controlled by a line-voltage thermostat. Setpoint shall be 80 deg F (adjustable). Fan operation shall be interlocked with intake and exhaust motor operated dampers which shall be proven open prior to fan energizing.

G. Ductless Split System Units (DSS-1/HP-1):

1. Unit shall be controlled by the manufacturer-provided thermostat through the packaged unit controls. On a call for cooling from the thermostat, the condensing unit shall energize, and the indoor fan coil supply fan shall cycle to maintain space temperature setpoint of 80 Deg. F (adjustable) cooling.
2. A condensate overflow switch in the indoor unit shall shut down the system in the event of a high condensate level and trigger an alarm to the BAS.

3. BAS shall monitor space temperature and unit status.

- H. Motor Operated Dampers: Located in relief louver in UTILITIES M010. Intake and exhaust dampers shall be interlocked with IEF-4 and be proven open by an endswitch prior to energizing the fan upon a call for cooling.

3.4 POINT LISTS

- A. The following point lists are provided as a minimum basis for control. Other points shall be provided as required to accomplish the Control Sequences and to provide a complete control system for automatic and safe control of the HVAC equipment.

END OF SECTION

SYSTEM POINT LIST

[illegible]

GENERAL NOTES:

PROVIDE ONE COLOR GRAPHIC PER UNIT WITH ALL DYNAMIC DATA SHOWN.

SYSTEM POINT LIST

[illegible]

GENERAL NOTES:

PROVIDE ONE COLOR GRAPHIC PER UNIT WITH ALL DYNAMIC DATA SHOWN.

SECTION 232000
HVAC PIPING

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) are hereby made a part of this section, and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. Piping to connect HVAC equipment, including the following:
 - 1. Refrigerant Piping
 - 2. Condensate Drain Piping

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Section 23 07 00, HVAC INSULATION.
- D. Section 23 09 00, INSTRUMENTATION AND CONTROL FOR HVAC.
- E. Section 23 30 00, HVAC AIR DISTRIBUTION.
- F. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.
- G. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.4 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Pipe and equipment supports.
 - b. Pipe and tubing, with specification, class or type, and schedule
 - c. Pipe fittings, including miscellaneous adapters and special fittings
 - d. Refrigerant valves and components

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

- A. Provide in accordance with specifications in Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).

2.2 PIPE AND TUBING

- A. Cooling Coil Condensate Drain Piping From Air Handling Units: Copper water tube, ASTM B 88, Type L, hard drawn copper tubing, or PVC.
- B. Refrigerant Piping--Copper Tubing: ASTM B 280, type ACR, cleaned, dehydrated and sealed seamless.

2.3 FITTINGS

- A. Copper Tubing:
 - 1. Solder Joint: Wrought copper, ANSI B16.22.
 - a. Solder for Drain Piping: 95-5 tin-antimony, ASTM B 32 (95TA).
 - b. Solder for Refrigerant Piping: Silver brazing alloy.
- B. Bronze Flanges and Flanged Fittings: ANSI B16.24.

2.4 DIELECTRIC FITTINGS

- A. Provide where copper and ferrous metal are joined.
 - 1. 2 Inch and Less: Threaded dielectric union.
 - 2. 2-1/2 Inch and Larger: Flange union with dielectric gasket and bolt sleeves.

2.5 FLEXIBLE CONNECTORS FOR REFRIGERANT PIPING

- A. Flexible bronze or stainless steel piping connectors shall be Spring-Flex type MFP, style BF as manufactured by Vibration Mountings and Controls, Inc.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. General:
 - 1. The drawings show the general arrangement of pipe and equipment but do not show all fittings and offsets that may be necessary.

2. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
3. Support piping securely. Refer to Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC). Suspended horizontal piping shall be supported by adjustable wrought steel clevis hangers. All supports shall be attached to the building structure and shall in no way be attached to the supports or other equipment, piping, or ductwork. Where supports bear on copper pipe, they shall be copper plated. Chain, strap, or other makeshift devices will not be permitted as hangers or supports. Maximum pipe support spacing shall be in accordance with Table 1 – MAXIMUM PIPING SUPPORT SPACING, except where grooved couplings are used, no pipe length shall be left unsupported between any two grooved couplings:

Table 1 - Maximum Piping Support Spacing

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (feet)	MAXIMUM VERTICAL SPACING (feet)
Copper or Copper-Alloy Pipe	12	10
Copper or Copper-Alloy Tubing, 1¼-inch Diameter and Smaller	6	10
Copper or Copper-Alloy Tubing, 1½-inch Diameter & Larger	10	10
PVC Pipe	4	10
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm		

4. Supports on condensate drain lines shall be provided with a 12" long section of hydrous calcium silicate, which shall have joints sealed and covered with a vapor barrier jacket. Hanger rods shall be 3/8" diameter size for pipes up through 2", 1/2" diameter size for 1-1/2" through 3". Pipe hanger rods shall be attached to the top chord only on steel joists and beams by joist or beam clamps without welding. Welding of support rods and connection at any place other than the top chord will not be permitted unless written approval is granted by the Architect.
5. Install piping generally parallel to walls and column centerlines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surface. Pipe shall be installed to permit free expansion and contraction without damage to joints or hangers. Slope piping down in the direction of flow not less than one inch in 40 feet. Provide eccentric reducers to keep bottom of sloped piping flat. All high points in water lines shall be provided with manual-air vents, all low points with drains. Condensate drain lines shall slope 1/8" per foot in direction of flow.
6. Anchors for pipe shall be provided as indicated or as required at the job site to localize expansion and contraction of pipe. Anchors shall consist of heavy steel or brass collars bolted or welded to the pipe and rigidly connected to the building structure unless indicated otherwise. Anchor braces shall not be attached in places where they will damage or injure the structure during installation or by the weight or expansion force of the pipe line after installation.
7. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line takeoffs with 3-elbow swing joints where noted on the drawings.

8. Connect piping to equipment as shown on the drawings. Piping connections to equipment shall be provided with unions or flanges.

B. Pipe Joints:

1. Sweated: Copper tubing shall be cut square, ends reamed, and all filings and dust wiped from interior of pipe. Joints shall be soldered with solder drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Solder shall be 95/5 composition; 50/50 will not be allowed.
2. Dielectric fittings such as couplings, unions, or flanges, shall be installed to isolate pipes of non-ferrous metal where connection is made to ferrous metal. Isolation shall be accomplished by non-metallic, unthreaded sleeves or gaskets or a combination of both. Fittings shall be so designed that the installing tools cannot come in contact with the insulating material. Materials shall withstand pressure and temperature as required.

C. Leak Testing: Inspect all joints and connections for leaks and workmanship and make corrections as necessary.

1. A hydrostatic test at 1.5 times design pressure for 4 hours. Factory tested equipment (converters, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.
2. Refrigerant Piping:
 - a. Refrigerant Piping System: The system shall be tested for tightness after installation and before insulation is applied. Controls and other equipment that may be damaged by the test pressure employed shall be temporarily removed or made inoperative before the tests are made and the openings shall be plugged or capped. Threaded, soldered, or brazed joints that leak shall be corrected by having the joints remade. Welded joints that leak shall be repaired by cutting out the faulty weld affected section and rewelding the joint or renewing the section of pipe.
 - b. Test Pressures: Refrigerant system test pressures for tightness shall not be less than ANSI 15 or ANSI B31.5 test pressures specified.
 - c. Charging the System for Test: The low and high pressure side of the system shall be charged with a dry, inert gas, such as nitrogen or anhydrous carbon dioxide using a small amount of the refrigerant gas to act as a tracer. A pressure limiting or reducing valve with pressure gage shall be used on the high pressure gas tank to limit the pressure in the system to the specified test pressure for the respective refrigerant.
 - d. Leakage Test: With the system charged to the desired pressure, the gas supply shall be tightly shut off and the system held for 30 minutes, during which time there shall be no loss of pressure. If a pressure drop, not attributable to temperature changes, occurs during this period the entire system shall be checked with a halide torch or an electronic leak detector. When leaks are found, they shall be repaired and another 30 minute period at the test pressure shall be made. Testing and repair shall continue until there is no loss of pressure.

- e. Evacuation: After completion of testing of refrigerant system for leaks, remove all air and moisture from the system by using a high vacuum pump. The pump shall be capable of reducing the absolute pressure in the system to a point where any water present in the lines will vaporize at a temperature appreciably below the ambient temperature and will be withdrawn from the system. Before conducting the evacuation test, inspect the vacuum pump oil for purity and provide new oil charge if existing charge is contaminated. Evacuate the system to a maximum absolute pressure of 0.020-inches of mercury (500 microns) or lower. During the evacuation, the ambient temperature shall not be less than 35 degrees F. Pressure gages shall be used for measurement of pressure. Upon achieving evacuation of system, valve off the vacuum pump from the system for a period of at least 12 hours. The system shall be considered tight and dry and free of air if the absolute pressure has not increased by more than .002-inches of mercury (50 microns) at the expiration of this period. Repeat the pressure test if the pressure rise exceeds 0.02-inches of mercury which indicates a leak in the system or presence of moisture. If no leaks are found, resume the evacuation test and continue until dryness of system is achieved. When a satisfactory vacuum has been obtained, it shall be broken with the introduction of vapor (no liquid) and subsequent sealing off of the system.
- f. Charging: Provide the initial charge of refrigerant. Charge by connecting the drums of refrigerant to the system charging connection, to feed the liquid refrigerant into the low side of the system where it will be evaporated. The gross and net weights of the drum shall be noted, and the drum placed on a scale so that it may be determined when it has been emptied. The charging connection shall be loosely connected to the system connection, so that the initial flow of refrigerant will expel air from the connection, following which the loose joint shall be tightened. When the system vacuum has been broken by the refrigerant, the compressor shall be started and operated while charging continues. The following procedures and precautions shall be exercised during the charging operation:
 - (1) The refrigerant condensing system shall be placed in operation.
 - (2) The fluid circulation system of water coolers or evaporator fans of a direct expansion system, shall be placed in operation.
 - (3) Compressor discharge pressure shall not be permitted to become excessive.

3.2 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

- A. Perform all tests and make reports in accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

END OF SECTION

SECTION 233000
HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC) are hereby made a part of this section, and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. Ductwork and accessories for HVAC including the following.
 - 1. Supply air, return air, and general exhaust systems
- B. Installation of control dampers and smoke detectors referred to in other Division 23 sections.
- C. Definitions:
 - 1. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
 - 2. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc. Publication entitled HVAC Duct Construction Standards Metal and Flexible, latest recognized edition.
 - 3. Duct Pressure Classifications:
 - a. General Duct System: 1-inch water column pressure class unless noted otherwise.
 - b. Variable Volume Duct System: 2-inch water column pressure classification for duct upstream of the variable volume dampers.
 - 4. Exposed Duct: Exposed to view in a finished room.
 - 5. Outside Duct: Exposed to view beyond the exterior side of walls or above the roof.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Section 23 07 00, HVAC INSULATION.
- D. Section 23 09 00, INSTRUMENTATION AND CONTROL FOR HVAC.

- E. Section 23 34 00, HVAC FANS.
- F. Section 23 81 00, DECENTRALIZED HVAC EQUIPMENT.
- G. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.4 QUALITY ASSURANCE

- A. Fire Safety Code: Comply with NFPA 90A.
- B. Duct System Construction: SMACNA standards are the minimum acceptable quality.
- C. Duct accessories exposed to the air stream, such as dampers of all types and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.5 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Volume, Motorized, and Backdraft Dampers
 - b. Roof Mounted Duct Supports
 - c. Prefabricated Metal Ductwork: Manufacturer's details for round and oval duct and fittings.
 - d. Duct Liner
 - e. Duct Access Doors, Panels, and Sections
 - f. Flexible ducts, connections fittings and clamps, with manufacturer's installation instructions.
 - g. Flexible connections
 - h. Air Outlets and Inlets
 - i. Louvers
 - j. Fire dampers

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A 653, coating G90.
- B. All ductwork exposed to view in finished spaces shall have paint grip to accept field painting.

- C. Joint Sealing: Refer to Paragraphs 2.2 and 2.3 for sealing requirements. In addition all general duct systems shall meet Seal Class C and shall comply with South Coast Air Quality Management District (SCAQMD) Rules 1113, 1168 and Green Seal Standards GS-11 and GS03 for VOC limits.
1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork. Use products as recommended by the manufacturer for each applicable system pressure. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 2. Tape: The use of pressure sensitive tape as a general duct sealant is not acceptable.
 3. A few of the many satisfactory sealants are as follows:
 - a. Moore Tuff-Bond, #29 for low pressure, #12 for high pressure.
 - b. Minnesota Mining and Manufacturing Company EC 800.
 - c. Hardcast R 6350 tape and activator/adhesive.
 - d. United Sheet Metal R-5966 (N), Listing #1.
 - e. Borden Arabol E-3806 lagging adhesive plus 6 ounce canvas.
 4. Gaskets in Flanged Joints: Soft neoprene.
- D. Approved factory-made joints such as DUCTMATE SYSTEM may be used. Locking-type longitudinal joints and seams, other than the snap-lock and button-lock types, need not be sealed as specified in this section.

2.2 METAL DUCTS

- A. Gages, Reinforcement, Joints, Seams, Sealing, Fittings, Supports, and Other Details per SMACNA: Construct ducts not shown otherwise for 2 inches wg static pressure rating.
- B. Sealing: All supply and return ductwork and plenums, regardless of pressure class, shall be sealed to SMACNA Seal Class A. Exhaust ductwork and plenums of pressure class greater than 2" shall be sealed to Seal Class A. All other exhaust ductwork and plenums shall be sealed to Seal Class C.
- C. Volume Dampers: Single louver type and multi-louver type as detailed in SMACNA. Maximum blade louver width shall be 8-inch. Volume dampers exceeding 8-inch shall be multi-louver type. Dampers shall be a minimum two gauges heavier than duct in which installed.
1. Manual dampers shall be opposed blade construction for modulating service. Manual operator mechanism shall be locking-type quadrant operator as manufactured by Young Regulator Company or equal. End of damper rod on each damper shall be grooved to show damper position. Quadrant operators shall be installed on 1-1/2" high 4-bend galvanized steel bracket allowing duct insulation to be extended and sealed under the quadrant operator. (Where dampers occur

behind or above finished portions of the building, operating rods shall be extended to 301 or 315 regulators installed flush with the finished surface.)

2. Motorized dampers shall be opposed blade construction for modulating service and parallel blade construction for two-position service. Motorized dampers shall be constructed with brass bearings, channel iron frame, interlocking blades and air-tight felt seals. Motor operators for dampers are specified in Section 23 09 00, INSTRUMENTATION AND CONTROL FOR HVAC.

- D. Backdraft Dampers: Self-operating, multi-blade damper to open fully on 0.06 inch wg pressure difference and close by gravity. Aluminum, 16 gage frame, 0.023-inch blades of flat or elliptical shape, with tie-bar to connect blades for parallel operation. Provide resilient gasket for air seal and quiet operation. Blade pivots shall be in the nylon bushings. Provide adjustable counter-balance weight(s) as necessary for proper operation.
- E. Turning Vanes: Provide in all square elbows even though not shown on the drawings. Turning vanes shall be factory fabricated. Vanes shall be hollow, double thickness in all ducts 18" or larger.
- F. Air Deflectors: Factory fabricated for air diversion and volume control with operator as required for location in an accessible position. Adjustable deflectors shall be Young Air Extractor Model 890 with worm gear operator when behind grilles, with 301 operator when above plaster ceilings, and with 433 operator when it is accessible.
- G. Provide a 4-inch diameter galvanized steel exhaust duct for all residential clothes dryers. Duct shall discharge outside the building and terminate with a weatherproof wall cap
- H. Plenums and Casings (Site Fabricated Units): Construct of galvanized steel panels joined by standing seams on outside of casing. Rivet or bolt all seams and joints on approximately 6" centers and seal with sealant. Reinforce with steel angles and provide diagonal bracing. Access doors shall be 36" x 18" with frame welded to plenum, three brass hinges and three brass tension fasteners operable from either side of door.
- I. Roof mounted duct supports shall be factory fabricated duct mounting pedestals as manufactured by Roof Products and Systems, Inc. (RPS) or equal. Pedestals shall be minimum 12 inches high, complete with equipment rail, slide channel "U" shaped mounting brackets, 18 gauge threaded galvanized rods, lateral spacer bracket and galvanized slide assembly. Supports shall be located to adequately support duct with no more than 4 feet of duct unsupported.

2.3 PREFABRICATED METAL DUCTWORK

- A. Gages, joints, seams, reinforcement, fittings, sealing, supports and other details for rectangular, round and oval duct shall be in accordance with SMACNA.
- B. All supply and return ductwork and plenums, regardless of pressure class, shall be sealed to SMACNA Seal Class A. Exhaust ductwork and plenums of pressure class greater than 2" shall be sealed to Seal Class A. All other exhaust ductwork and plenums shall be sealed to Seal Class C.

- C. Ducts and Casings: Submit details of proposed joints/sealing system. Unless shown otherwise, construct supply duct to 2 inches wg static pressure. Provide bolted construction and tie-rod reinforcement where required.
- D. Round and Oval Ducts:
 - 1. Spiral duct and all fittings shall be Semco, MKT or United McGill spiral lock-seam duct.
 - 2. Elbows: Diameters 3 through 8 inches shall be two sections die stamped, all others shall be gored construction with all seams continuously welded. Coat galvanized areas of fittings damaged by welding with corrosion-resistant aluminum paint or galvanized repair compound.
 - 3. Provide bellmouth, conical tees, laterals, reducers, and other low loss fittings as shown in SMACNA Standards.
- E. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Architect/Engineer.
- F. Duct Hangers and Supports: Refer to SMACNA. Avoid use of trapeze hangers for round duct.

2.4 DUCT LINER (WHERE INDICATED ON DRAWINGS FOR TRANSFER DUCTS)

- A. General: Liner shall be 1 inch thick, fiberglass duct liner with a smooth mat, bonded surface on air side. Liner shall meet ASTM C1071 with excellent abuse resistance and shall not support mold or fungus growth. Flame spread, fuel contribution, and smoke development ratings shall comply with NFPA Standard 90A and ASTM E84.
- B. 'K' Value: 0.26 at 75 Deg. F, ASTM C518.
- C. Noise Reduction Coefficient: 0.60 or higher based on "Type A mounting" and tested in accordance to ASTM C423.
- D. Air Surface Coating: Acrylic coating treated with EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.
- E. Maximum Velocity: 5,000 ft/min.
- F. Adhesive: Meets ASTM C916.
- G. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

2.5 DUCT ACCESS DOORS, PANELS AND SECTIONS

- A. Provide access doors in accordance with NFPA 90A, sized and located for maintenance work, upstream where possible, in the following locations:
 - 1. Each automatic control dampers.
 - 2. Any mechanical equipment located above hard ceilings.

3. Each fire damper.
4. Each apparatus requiring service or inspection.

B. Openings shall be 15" x 18" unless noted otherwise, except where size of duct will not accommodate this size, they shall be made minimum 12"x12" square. Where 12"x12" square opening is not practical, a flanged, removable duct section shall be utilized in accordance with VMC 607.4.1. Access doors shall be of rigid type and shall be provided with gasket to make air tight. Door shall be provided with galvanized hinges having bronze pins and two approved brass fasteners. Access doors in insulated ducts shall be of the insulated type. Doors shall swing so that fan pressure or suction and direction of air flow holds the door closed.

1. For Rectangular Ducts: Refer to SMACNA and provide lock type 2 (door latch, not sash lock).
2. For Round Ducts: Access sections shall be not less than 20 gage housing welded or riveted to a duct section.

2.6 FLEXIBLE AIR DUCTS

A. General: Factory fabricated, complying with NFPA 90A for connectors up to 14 feet maximum length and not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier as defined in Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC). Provide approximate lengths indicated on the drawings. Provide insulated, acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be acoustically insulated type as manufactured by Thermaflex or Flexmaster. Duct shall be fabricated with an acoustically transparent CPE inner film, 1" fiberglass insulation, and reinforced metalized vapor barrier. Vapor barrier permeance shall be .05 per ASTM E96, Procedure A. The rated positive pressure shall be 10" water gage and the recommended operating pressure for 90 degree bends shall be 6" water gage for 12" diameter duct. The minimum 'R' value shall be minimum 4.2, except in unconditioned attic type spaces the minimum 'R' value shall be 5.5. Entire assembly shall have maximum Flame-Spread rating of 25, a Smoke Developed Rating less than 50, and shall meet all NFPA 90A requirements. Connections between flexible duct and ductwork fittings or diffusers shall be made with draw bands and sealed with an approved pressure-sensitive tape. Flexible duct shall be UL 181 listed, ETL Class1.

Duct Insertion Loss, dB

Octave Band Frequency, Hz	2 125	3 250	4 500	5 1000	6 2000
6 inch duct	7	19	34	37	38
8 inch duct	8	13	29	35	36
12 inch duct	20	26	27	33	26

C. All round duct take-offs shall be made with SPIN-IN fittings or pre-manufactured tap fittings with flanged low-loss boot and round connection collar. Units shall have a balancing damper and a factory-installed spring-loaded retractable bearing and a positive locking

wing nut for easy readjustment. Provide 2" insulation stand-off for balancing damper handle.

- D. Connection between high velocity duct and variable air volume boxes shall be made with high pressure flexible duct runouts unless shown otherwise. Insulation shall be a nominal 1-inch by 1 lb/cf fiberglass sheathed in a seamless vapor barrier jacket. The duct shall be rated for 15 inches of water pressure. Connection between flexible duct and ductwork fittings or variable air volume boxes shall be by manufacturer's recommendations. The duct shall comply with the latest NFPA Bulletin 90A and be listed as Class 1 connector, UL Standard 181.

2.7 FLEXIBLE CONNECTIONS

- A. Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 29 ounce neoprene coated fiberglass fabric approximately six inches wide. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws two inches on center. Fabric shall not be stressed other than by air pressure. Allow at least one inch slack to ensure that no vibration is transmitted.

2.8 INSTRUMENT TEST FITTINGS

- A. Manufactured type with a minimum two-inch length for insulated duct, and a minimum one-inch length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil and cooling coil.

2.9 AIR OUTLETS AND INLETS

- A. Materials:
 - 1. Steel or aluminum as indicated. Provide manufacturer's standard gasket.
 - 2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel. Provide concealed method of fastening where available.
- B. Performance Test Data: In accordance with Air Diffusion Council Code 1062R4.
- C. Finish: White baked enamel for ceiling mounted units. Wall-mounted units shall be primed.
- D. Air Supply Outlets and Inlets: Manufacturer shall be Price Industries, Titus or Metal-Aire. Basis of Design Price Industries model numbers are listed.
 - 1. Lay-in Supply Diffusers with round necks shall be Model SCDA 24" x 24" adjustable pattern square cone diffuser for lay-in mount for inverted T-bar ceiling. Provide equalizing deflectors. Construction shall be steel with mitered blade joints.

2. Lay-in Supply Diffusers with rectangular necks (151 TRAINING) shall be Model SMDA 24" x 24" adjustable louvered face directional diffusers for lay-in mount for inverted T-bar ceiling. Provide square-to-round neck transition and equalizing deflectors. Construction shall be steel with mitered blade joints.
3. Surface Mounted Supply Diffusers with round necks shall be Model SCDA 12" x 12" adjustable pattern square cone diffuser for surface mounting. Provide equalizing deflectors. Construction shall be steel with mitered blade joints. Diffusers shall be surface-mounted in the center of acoustical ceiling tile.
4. Surface Mounted Supply Registers shall be Type 520 Steel double deflection and shall have free area of not less than 75%. Register dampers shall be Steel opposed blade type, face operated. Sponge rubber gasket shall be provided on frame where surface mounted.
5. Surface Mounted Exhaust Registers shall be Model 530 fixed blade Steel construction with 45 degree deflecting vanes on 3/4" centers. Units shall have free area not less than 75%. Register dampers shall be Steel opposed-blade face-operated type. Sponge rubber gasket shall be provided on frame where surface mounted.
6. Lay-in Exhaust Registers shall be Model PDDR perforated face. 24" x 24" modules shall be suitable for lay-in mount for inverted T-bar ceilings and include rectangular duct connections. Perforated face shall have no less than 51% free area and be hinged and removable with quick-release spring latches. Provide manufacturer rectangular register damper.
7. Return air lay-in filter grilles shall be Model 530 Steel construction for nominal 24 x 24 lay-in inverted Tee Bar ceiling. Blades shall be 45 degrees deflection.
8. Linear Bar Supply and Return Grilles shall be Model LBP linear bar grilles with Blades shall be spaced at 1/2". Supply grilles shall be provided with 15-degree deflection extruded aluminum cores. Provide with 1" border suitable for surface mounting.
9. Linear Slot Diffusers shall be extruded aluminum Series SDS adjustable pattern type complete with mounting frame for lay-in application, acoustically-lined duct plenum (SDBI), and accessories. Insulation type shall be fiber free foam. Provide slot quantity and width as indicated on drawings.

2.10 LOUVERS

- A. Wall Louvers (6" Aluminum): Louvers shall be Greenheck Model ESD-603, Louvers and Dampers Inc. Model IL-23, or equal stationary drainable blade with 6" deep frame and 0.08" thick extruded aluminum construction. Blades shall be positioned at approximately 37 degree angle and spaced not to exceed 4 inches on center. A channel in each blade shall drain water to downspouts in jambs and mullions to prevent water cascade from blade to blade. Provide complete with 1/2" mesh matching bird screen in removable frame and extended sill. Louver shall be AMCA certified for air performance and water penetration. Water penetration shall not occur while the free area velocity is maintained less than 1,000 feet per minute. Louvers shall be sized as noted on drawings, with a static pressure drop not to exceed 0.10 inches water column for a 48" x 48" louver. Finish shall be as selected by the Architect and submitted for approval.

2.11 FIRE DAMPERS

- A. General - Fire dampers shall be dynamic type. Dampers shall meet local codes and the standards of the National Fire Protection Association contained in Bulletin 90A. Dampers in ductwork shall be sized so that the free air space is not less than the connected duct free air space. (Damper installed behind grilles or registers shall be the same size as the grille or register with blades in the air stream.) Location shall be as shown on drawings or as required by local code. Dampers shall possess a 1-1/2 hour standard fire protection rating in accordance with NFPA No. 555.
- B. Material - The frame shall be constructed so as to be unaffected by corrosion or high heat. Mechanical parts shall have bronze non-corrosive pins. Vertical and horizontal dampers shall feature closure spring operation suitable for closure against the installed system air stream. When closed, the dampers shall be held closed by a catch arrangement. Blades installed in regular ductwork will not be accepted.
- C. Fuse Links - Fire curtains shall be arranged to close automatically and remain tightly closed upon the operation of an approved fusible link or other approved heat-actuated device, located where readily affected by an abnormal rise of temperature in the duct. Fusible links shall have a temperature rating approximately 50 Deg. F above the maximum temperature that would normally be encountered when the system is in operation or shut down.
- D. Access doors shall be provided in accordance with NFPA 90A. Suitable openings shall be provided to make fire dampers accessible for inspection and maintenance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), particularly regarding coordination with other trades.
- B. Fabricate and install ductwork and accessories in accordance with SMACNA Standards:
 - 1. Duct clearance and lengths shall be established from measurements taken at the job site before any ducts are fabricated. The Contractor will not be allowed any extra costs for ducts fabricated and then found not to fit into the space intended. Duct sizes on the drawings are actual sheet metal dimensions which shall be altered by the Contractor to other dimensions producing the same air handling characteristics where necessary to avoid interferences and clearance difficulties. Acoustically lined duct has been sized to include the lining.
 - 2. Fire damper openings shall be established from measurements taken at the job site before any fire damper is fabricated. The Contractor will not be allowed any extra costs for dampers fabricated and then found not to fit into the space intended. The Contractor shall coordinate clearances for locating the damper blades out of the air stream as required.

3. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA. Weld sheet metal in accordance with SMACNA, Guidelines for Welding Sheet Metal. Repair damaged galvanized areas with galvanizing repair compound.
 4. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA.
 5. Construct casings and pipe penetrations in accordance with SMACNA. Design casing access doors to swing against air pressure so the pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA. Duct supports shall consist of not less than 1" x 16 ga. galvanized steel strap hangers spaced not over 8'-0" on center for ducts with up to 240" perimeter.
- D. Duct floor and wall openings - Rectangular and square ducts shall have openings 1" larger than the overall duct dimensions framed in place when the wall is constructed and 1/4" larger when floors are poured. Space between duct and structure shall be filled with duct insulation, except in fire partitions or floors they shall be packed tight with non-combustible fiber rope. Flanges constructed of 22-gauge galvanized sheet metal, not less than 3" wide, shall be installed at each opening in finished areas.
- E. Flexible Duct Installation: Continuous, single pieces not over fourteen feet long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with adhesive and clamps or screws as recommended by the duct manufacturer. Flexible ducts shall not penetrate any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hours.
- F. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.
- G. Control Damper Installation:
1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
 2. Assemble multiple section dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
 3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
- H. Duct Liner: Install in accordance with SMACNA and NAIMA (North American Insulation Manufacturers Assoc.) Apply in cut-to-size pieces to the entire interior of the duct with approved adhesive and secured with fasteners. Fasteners shall be metal washer type and mechanically secured or welded to the duct. Adhesive type fasteners are not acceptable. Edges, joints, and penetrations shall be coated with adhesive meeting ASTM C916.

- I. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.
- J. Installation of Diffusers, Registers, and Grilles: Ducts shall be fastened securely to the building construction at each side of opening. Diffuser, register, or grille shall be securely fastened thereto, snug against the wall.
- K. Installation of Fire Dampers: Dampers shall be installed so as to provide the positive barrier to passage of air when in a closed position. Dampers shall be located and installed so that destruction of the duct on either side of the damper will not allow the damper to fall away from the opening to be protected. Dampers shall be located in the wall or ceiling, or as close thereto as possible, and securely fastened thereto. Where it is not possible to locate the damper directly adjacent to the wall or ceiling, it shall be located as close as possible and all ductwork between the damper and wall or ceiling shall be fireproofed with plaster or other approved methods to give a rating equal to the rating of the damper. Access doors in the duct and wall or ceiling where applicable shall be sized and located as required for inspection and maintenance of the damper. Damper installation shall be as recommended by the manufacturer for UL compliance and shall meet all requirements of NFPA Standard 90A. Dampers shall be installed with sufficient tension to prevent rattling or vibration. The installation of the dampers shall conform to the requirements of SMACNA.
- L. Smoke Detectors shall be provided and installed by the Electrical Contractor, as specified in Division 26.
- M. Connection of horizontal ducts to rooftop exhaust fans shall be made using radiused elbows or mitered elbows with turning vanes. Duct transitions shall be as hereinbefore specified.
- N. Ductwork associated with clothes dryer exhaust shall have smooth interior finish with joints running in the direction of airflow.

3.2 DUCT LEAKAGE TESTS AND REPAIR

- A. Low Pressure Ducts: Seal visible openings and seal air leaks audible at operating conditions.

END OF SECTION

SECTION 233400
HVAC FANS

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), are hereby made a part of this section and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. Fans.
- B. Product Definitions: AMCA Publication 99, Standard 1-66.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Section 23 09 00, INSTRUMENTATION AND CONTROL FOR HVAC.
- D. Section 23 30 00, HVAC AIR DISTRIBUTION.

1.4 QUALITY ASSURANCE

- A. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.
- B. Fans and power ventilators shall comply with the following standards:
 - 1. Testing and Rating: AMCA 210.
 - 2. Sound Rating: AMCA 300.
- C. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

1.5 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Inline centrifugal fans

2. Sound power levels for each fan.
3. Maintenance and operating manuals in accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
4. Fan curves for each fan showing CFM versus static pressure, efficiency, and horsepower for design point of operation and at 110 percent of design static pressure. Include product application data to indicate the effect of capacity control devices such as inlet vane dampers on flow, pressure and horsepower.

PART 2 - PRODUCTS

2.1 INLINE CENTRIFUGAL FANS:

- A. Type: Greenheck Model as indicated on drawings or equal by PennBarry, Twin City, or Cook, centrifugal fan, backward inclined.
- B. Construction: Straight through blower complete with backward curved non overloading aluminum blades, rubber mounted motor, square steel enclosure, rubber in shear vibration isolators, and disconnect switch wired to motor. Unit shall be suitable for mounting at any angle. Power unit shall be accessible without disconnecting ductwork. Housing shall be internally lined with 1" thick fiberglass insulation. Disconnect switch sized for horsepower and voltage requirements of motors shall be provided. Provide speed controller for air balance.
- C. Motor and Drive: Refer to Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC). Drive shall be direct drive ECM. Bearings shall be pre lubricated and sealed at the factory.
- D. All fans shall bear the AMCA Certified Ratings Seal for both air and sound performance.
- E. Finish Painting: Baked on epoxy paint for entire unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.

3.2 PRE-OPERATION MAINTENANCE

- A. Grease bearings.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

3.3 START-UP AND INSTRUCTIONS

- A. Check vibration and correct as necessary for air balance work.
- B. Check operation of backdraft or motor operated damper.

END OF SECTION

SECTION 238100
DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), are hereby made a part of this section and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. Split System Air Conditioning Units
- B. Package Rooftop Heat Pump Units
- C. Ductless Split System (Heat Pump) Air Conditioners
- D. Definitions:
 - 1. Energy Efficiency Ratio (EER): A ratio calculated by dividing the cooling capacity in Btuh by the power input in watts at any given set of rating conditions, expressed in Btuh per watt (Btuh/watt).
 - 2. Unitary (ARI): Consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 09 00, INSTRUMENTATION AND CONTROLS FOR HVAC.
- C. Section 23 30 00, HVAC AIR DISTRIBUTION.
- D. Section 23 34 00, HVAC FANS.
- E. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.4 QUALITY ASSURANCE

- A. Safety Standards:
 - 1. Design, manufacture and installation of mechanical refrigeration equipment: ANSI B9.1.
 - 2. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of

height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated unit casings.

- B. Unit Capacities: When providing a substitution to the basis of design manufacturer for the Variable Refrigerant System, the Contractor shall ensure the system meets the heating and cooling capacities specified in the equipment schedules and is responsible for any additional materials that include but are not limited to higher capacity outdoor an indoor units, refrigerant piping, and accessories required for proper operation.

1.5 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Unitary Air Conditioners:
 - (1) Split System Air Conditioning Units
 - (2) Package Rooftop Heat Pump Units
 - (3) Ductless Split System Air Conditioners
 - 2. Submit proof of specified ARI Certification.
 - 3. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required EER, COP, etc.
 - 4. Operating and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).

1.6 EXTRA MATERIALS

- A. Furnish one set of air filters for each unit.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR HANDLING UNITS (AHU-1):

- A. Equipment and material specified under this heading shall be Trane Model indicated on drawings, furnished and installed by a certified representative of the unit manufacturer.
- B. Unit Construction: All unit panels shall be 2" solid, double-wall minimum R-13 construction to facilitate cleaning of unit interior. Unit panels shall be provided with a mid-span, no-through-metal, internal thermal break. Casing construction will comply with NFPA 90A. All exterior and interior indoor AHU panels shall be made of galvanized steel. Unit to ship unpainted from factory.

- C. Casing Deflection: The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.00 times design static pressure. Total maximum design static shall not exceed +10 inches w.g. in all positive pressure sections and -10 inches w.g. in all negative pressure sections.
- D. Floor Construction: The unit floor shall be of sufficient strength to support a 300.0 lb load during maintenance activities and shall deflect no more than 0.0042 inch per inch of panel span.
- E. Unit Base: Manufacturer shall provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Indoor unit base frame shall either be bolted construction or welded construction.
- F. Insulation: Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft²-h-°F/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented.
- G. Drain Pan: In sections provided with a drain pan, the drain pan shall be designed in accordance with ASHRAE 62.1. The drain pan shall be sloped in two planes promoting positive drainage to eliminate stagnant water conditions. Drain pan shall be insulated, and of double wall construction. The outlet shall be the lowest point on the pan, and shall be of sufficient diameter to preclude drain pan overflow under normally expected operating conditions. All drain pans connections shall have a threaded connection, extending a minimum of 2-1/2" beyond the unit base, and shall be made from the same material as the drain pan. Drain pan located under a cooling coil shall be of sufficient size to collect all condensate produced from the coil.
- H. Access Door Construction: Access doors shall be the same R value as the main unit casing. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels respectively. All doors shall be provided with a thermal break construction of door panel and door frame. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage. Surface mounted handles shall be provided to allow quick access to the interior of the functional section and to prevent through cabinet penetrations. Handle hardware shall be designed to prevent unintended closure. Outswing doors shall have easily removable hinges and handles that can be relocated the change the door swing if needed. Door hinges shall be stainless steel. All doors shall be a minimum of 60" high when sufficient height is available or the maximum height allowed by the unit height. A single door handle linked to multiple latching points shall be provided for each door.
- I. Mixing Section: A mixing section shall be provided to support the damper assembly for outdoor, return, and exhaust air.
- J. Dampers: Dampers shall modulate the volume of outdoor, return, or exhaust air. The dampers shall be of double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on all blades. The blades shall rotate on stainless-steel sleeve bearings. The dampers shall be rated for a maximum leakage rate of 3 cfm/ft² at 1 in. w.g. complying with ASHRAE 90.1 maximum damper leakage. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Dampers may be arranged in a parallel or opposed-blade configuration.

- K. Filters: Mixing section shall be provided with a filter rack. 2-inch pleated media filters shall be made with 100% synthetic fibers that are continuously laminated to a supported steel-wire grid with water repellent adhesive. Filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity. The filters shall have a MERV 8 rating when tested in accordance with the ANSI/ASHRAE Standard 52.2.
- L. Averaging Temperature Sensor: An averaging temperature sensor shall be serpentine across the module. All capillaries bends shall be radiused and fastened with capillary clips to prevent crimping and minimize wear. A 10,000 ohm, Type II thermistor is the sensor material that shall be mounted.
- M. Mixing Section Damper Actuators: Spring return actuators shall be mounted with the outside air damper normally closed and the return air damper normally open. Actuator feedback shall be wired to the unit controls system.
- N. Dirty Filter Switch: A differential pressure switch shall be piped to both sides of the filter and indicate filter status.
- O. Coil Section with Factory Installed Coil: The coil section shall be provided complete with coil and coil holding frame. The coils shall be installed such that headers and return bends are enclosed by unit casings. If two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil and be of the same material as the primary drain pan. Like the primary drain pan, the intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
- P. Coil with Inspection Access: The coil section shall include an inspection section complete with a double-wall, removable door downstream of the coil for inspection, cleaning, and maintenance. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively. All doors shall be provided with a thermal break construction of door panel and door frame. In lieu of a door, an easily removable service panel shall be provided in sections as specified, to facilitate access to unit for periodic servicing, or for removal and replacement of coils. Removal of service panel shall not impact the structural integrity of the unit.
- Q. Refrigerant Cooling Coils: The coils shall have aluminum fins and seamless copper tubes. The fins shall have collars drawn, belled, and firmly bonded to tubes by mechanical expansion of the tubes. Suction and liquid line connections shall extend to the unit exterior. The coil casing may be galvanized or stainless steel. The coils shall be proof-tested to 715 psig and leak-tested to 300 psig air pressure under water. After testing, the inside of the coils shall be dried, all connections shall be sealed, and the coil shall be shipped with a charge of dry air. Suction headers and liquid connections shall be constructed of copper tubing with connections penetrating unit casings to permit sweat

connections to refrigerant lines. The coils shall have equalizing vertical distributors sized according to the capacities of the coils. Refer to the Product Data section of the submittals for AHRI certification status. Refrigerant coil tubes shall be 1/2" OD, 0.016" thick, internally enhanced copper.

- R. Leak Detection Sensors: Factory-installed A2L class gas sensors designed for R454B and R32 refrigerant detection will be installed in the DX coil sections selected with R454B or R32 refrigerant. Sensor shall utilize thermal conductivity technology for quick and accurate leak detection and features automated self-calibration, self-diagnostics, immunity to poisoning and a 15 year life. Sensor shall come set with a 15% LFL alarm threshold with +/-2.5% accuracy at 68F (20C) and +/-5% accuracy across the rest of the operating range of -40F - 175F (-40C - 80C). Coil connections shall be stubbed into the tunnel adjacent to the coil section.
- S. Averaging Temperature Sensor: An averaging temperature sensor shall be serpentine across the module. All capillaries bends shall be radiused and fastened with capillary clips to prevent crimping and minimize wear.
- T. Electric Heat: A UL-recognized electric heater shall be factory installed in the air handler. The heater shall be an open-coil configuration with Type A wire (80% nickel and 20% chromium) derated to a maximum watt density of 35 watts per square inch. Safeties shall include three-pole, disconnecting-type contactors, airflow switches, automatic-reset functional limits, automatic-reset high-temperature limits, and manual-reset high-temperature limits. The contactors for energizing the electric heater shall be magnetic contactors. Electric heaters above 48 amps shall be fused into circuits not to exceed 48 amps as required by UL and NEC. Kilowatt output shall be selected to the nearest 0.1 kW of scheduled kilowatt. Electric heater section shall include a circuit breaker disconnect with a beside-the-door interlocking handle, spring loaded and designed to rest only in the full ON or OFF state, and shall be lockable in these states.
- U. Heater Control: The electric heater shall be factory-wired to accommodate SSR-Vernier control. The SSR control can receive a 0-10VDC signal from a standalone thermostat or building automation system providing full modulating control of the first increment of heat. The staged increments shall be turned on and off by a step controller. As each stage is required to fulfill the demand for heat, the SSR increment shall be used as fully modulating between stages. A 10,000 ohm, Type II thermistor is the sensor material that shall be mounted.
- V. Access / Inspection / Turning Section: A section shall be provided to allow additional access/inspection of the heating element. An access door shall be provided for easy access. All access sections shall be complete with a double-wall, removable door downstream for inspection, cleaning, and maintenance. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.
- W. Direct Drive Plenum Fan Section: The fan type shall be provided as required for stable operation and optimum energy efficiency. The fan shall be a single-width, single-inlet, multiblade-type direct-drive plenum fan. Motor bearing life of the direct-drive plenum fan shall be not less than L-10 250,000 hrs. Fans that are selected with inverter balancing

shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground. On units supplied with plenum fans, door guard(s) shall be supplied on the access door(s) to the fan and those downstream access door(s) where unintended access to the plenum fan could occur.

- X. Fan Discharge Temperature Sensor : Button or probe temperature sensor shall be mounted in the fan discharge. A 10,000 ohm, Type II thermistor is the sensor material that shall be mounted.
- Y. Flow Meter – Standard Transmitter: The fan shall have an airflow measurement system to measure fan airflow directly or to measure differential pressure that can be used to calculate fan airflow. The system shall predict airflow within +/-5 percent total accuracy (device & transmitter) when operating within the stable operating region of the fan curve. On units supplied with multiple direct drive fans, one fan is tubed and one transmitter is supplied for the total array. The submitted fan airflow performance and noise levels shall not be affected by the installation of the device. Any device that provides an obstruction to the fan inlet will not be accepted.
- Z. Combination VFD / Disconnect: A combination Variable Frequency Drive (VFD) / disconnect shall be provided when variable air volume control is required for fan operation. Whether for single fan, dual fan, or fan array applications, a single VFD shall be provided to ensure proper operation and to optimize operating life. Each VFD / disconnect shall be properly sized, factory mounted in a full metal enclosure, wired to the fan motor(s), and commissioned to facilitate temporary heating, cooling, ventilation, and/or timely completion of the project. VFD / disconnects shall include a circuit breaker disconnect with a through-the-door interlocking handle and shall be lockable. The VFD package shall also include:
 - 1. Electronic manual speed control
 - 2. Hand-Off-Auto (H-O-A) selector switch
 - 3. Inlet fuses to provide maximum protection against inlet short circuit
 - 4. Current limited stall prevention
 - 5. Auto restart after momentary power loss
 - 6. Speed search for starting into rotating motor
 - 7. Manual motor protection MMP

VFD shall be mounted externally in a NEMA Type 1 enclosure on the supply fan section. An external disconnect shall be mounted through-the-door to the VFD to disconnect full power from VFD. The return/exhaust fan's VFD shall be mounted internal of unit casing in the controls section. The internal enclosure shall be an integral part of the unit casing to allow for thermal venting to casing interior, but shall be accessible from unit exterior through access door. Internally mounted starters shall have doors with the same construction as other doors on unit. An external disconnect shall be mounted through the door to the VFD to disconnect full power from VFD. Design VFD frequency is less than

line frequency. Use caution during startup to ensure the VFD will not operate at the line frequency, or ensure that the air delivery system can handle being over-pressurized.

- AA. Motor Wiring Conduit: The fan motor wiring shall be factory-wired to the unit-mounted disconnect, variable frequency drive, or external motor junction box within flexible metal conduit of adequate length so that the fan vibration isolation will not be restricted. To maintain the 65kA short circuit current rating (SCCR) with the single point power selection, dedicated class J or T fusing shall be field installed. There is a maximum allowable fuse size as follows: 150 amps (conductor size 1-6) or 200 amps (conductor size 2/0-6) for a 65 A or less supply panel FLA, 200 amps (conductor size 2/0-6) or 400 amps (conductor size 400-3/0) for a 65.01 A to 90 A supply panel FLA, and 200 amps (conductor size 2/0-4) or 600 amps (conductor size 500-3/0) for a 90.01 A to 160 A supply panel FLA.
- BB. Variable Volume Control System: Factory-mounted direct-digital control (DDC) systems shall be engineered, mounted, wired, and tested by the air handler manufacturer. Each control system shall be fully functional in a stand-alone mode or may be tied to a building automation system with a single pair of twisted wires. All factory-mounted controls shall be covered by the air handler manufacturer's standard warranty.
- CC. Programmable Controller: A dedicated programmable Controller with the appropriate point capabilities shall be unit mounted on the air handling unit. Point expansion shall be accomplished using expansion modules with the capacity to add points in 4 to 18 point increments. The controller shall utilize the latest graphical programming methods that are easy to learn, powerful, self-documenting. 120V power wiring to the control system transformer, which provides 24VDC to the controller and 24VAC to the end devices, shall be customer supplied. The controller communicates shall use the BACnet protocol. The controller shall have USB Host Port, USB Service Tool Port, two 100M Ethernet Ports, and uSD Card Socket for expandable flash memory. Other advanced features shall include automated controller back-up, and optional features such as secure remote connectivity, wireless building communications, mobile device connectivity, and custom programming with expandable I/O.
- DD. Unit Mounted Controller: All factory installed end devices shall be wired and terminated to expansion modules throughout the unit. The expansion modules shall communicate to the DDC controller with a communication bus.
- EE. Standard Factory Programming: Standard Factory Programming shall be installed to unit.
- FF. Lifting Instructions: The air handling units must be rigged, lifted, and installed in strict accordance with the Installation, Operation, and Maintenance. The units are also to be installed in strict accordance with the specifications. Units may be shipped fully assembled or disassembled to the minimum functional section size in accordance with shipping and job site requirements. Indoor units shall be shipped on an integral base frame (variable from the standard 4" to 10" height) for the purpose of mounting units to a housekeeping pad and providing additional height to properly trap condensate from the unit. The integral base frame may be used for ceiling suspension, external isolation, or as a housekeeping pad. All units shall be shipped with an integral base frame designed with the necessary number of lift points for safe installation. All lifting lugs shall be utilized during lift. The lift points shall be designed to accept standard rigging devices and be

removable after installation. Units shipped in sections shall have a minimum of four points of lift.

2.2 SPLIT SYSTEM CONDENSING UNIT (CU-1):

- A. General: Equipment and material specified under this heading shall be furnished and installed by a certified representative of the unit manufacturer. Condensing unit shall be Trane Model indicated on drawings and shall be selected and submitted together with the associated air handling unit (AHU-1). Air-cooled condensing unit shall have scroll compressors and be factory assembled and wired. Unit shall ship from the factory with a nitrogen holding charge. Unit shall be constructed of 14-gauge welded galvanized steel frame with 14 and 16-gauge galvanized steel panels and access doors. Unit shall have factory mounted, louvered, full-length steel grilles to protect condenser coils and piping. Unit surface shall be finished with an air-dry paint. Paint shall withstand a minimum of 672 consecutive-hour salt spray application in accordance with standard ASTM B117.
- B. Unit Control: Factory shall provide 115-volt control circuit which includes fusing and control power transformer. Unit shall be provided with factory controller and shall be application-specific, programmable factory installed and designed to control packaged HVAC equipment. Touch sensitive color user interface shall provide at-a-glance operating status, performance monitoring, scheduling changes, and operating adjustments. Unit controller shall have provision for automatic control from and full communications with Trane building control systems.
- C. Phase Monitor: The unit shall be equipped with a phase monitor in the control box. The phase monitor shall protect against phase loss, imbalance and reversal of the line voltage.
- D. Compressors: Scroll compressor shall provide low vibration and shall have a completely enclosed compression chamber with no leakage paths. The compressor shall be suction gas cooled, direct drive, with 3600 rpm hermetic motors. Compressor shall include a centrifugal oil pump, oil level sight glass, and an oil charging valve.
- E. Refrigerant Management: Each compressor shall have crankcase heaters installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during of cycles. Additionally, the condensing unit shall have controls to initiate refrigerant isolation at system shut down on each refrigerant circuit. To be operational, the refrigerant isolation cycle shall require a field-installed isolation solenoid valve on the common liquid line near the evaporator.
- F. Dual Refrigerant Circuit: Unit shall have dual refrigeration circuits. Each circuit shall have three (3) compressors piped in parallel. Six step capacity control shall be accomplished through compressor cycling.
- G. Variable Air Volume Control: Unit controller shall provide dynamic temperature control based on controlling capacity staging to meet the discharge cooling setpoint. The discharge cooling setpoint shall be adjustable from 40°F to 75°F. Discharge temperature sensor shall ship with the unit for field mounting.
- H. Low Ambient Control: Low ambient control shall extend unit operation from 40 deg F to 0 deg F utilizing an external damper assembly for head pressure control.

- I. Suction Service Valve: Refrigerant shutoff valve shall be provided to isolate the compressor for servicing.
- J. Pressure Gauges: Pressure gauges shall be provided for monitoring suction and discharge pressure. One set shall be provided for each circuit. Guges shall be ship-with for field installed.
- K. Spring Vibration Isolators: Spring vibration isolators shall be supplied for field installation under the unit base to minimize transmission of unit vibrations. Isolators shall consist of a cast, spring loaded, telescoping housing as the isolation medium. Mountings shall include built-in leveling bolts, resilient inserts that act as centering guides, and ribbed neoprene acoustical pads bonded to the bottom of the isolator. The kit shall include instructions for field installation.

2.3 PACKAGED ROOFTOP HEAT PUMP UNITS (RTU-1):

- A. General - Equipment and material specified under this heading shall be furnished and installed by a certified representative of the unit manufacturer. Rooftop air conditioning unit shall be Trane Model indicated on drawings, and shall be a complete, self-contained unit with hermetic motor-compressor, cooling coil, supply fan, electric heating section, condenser coil and fan(s), economizer/power exhaust, dampers, filters, changeover valves and piping, interconnecting piping, filter-dryer, sight glass, roof curb, controls, and wiring enclosed in a weather-resistant steel enclosure suitable for roof mounting. Provide electrical starters and single point power connection. Three phase units shall be provided with phase loss monitoring. Supply fan motor shall be direct drive. Provide a trap in the condensate drain piping from the evaporator coil drain pan of sufficient depth to prevent blowout or siphoning of water. Unit shall be fitted and rated in accordance with ARI Standard 240. Provide compressor anti-short cycling control and low ambient control for cooling operation to 0 Deg. F. Provide hail guards for intake and discharge openings to protect condenser fans and coils. Where units are indicated to have hot gas reheat, factory mounted hot gas reheat coil, associated piping, accessories, and controls shall be provided.
- B. Unit Casing: Unit casing shall be, zinc coated, heavy gauge, galvanized steel construction. All metal-to-metal seams shall be sealed air and weather-tight, requiring no caulking at job site. Exterior surface shall be finished with weather resistant baked enamel finish suitable for outside, roof mounting. Unit casing shall be insulated with 1 inch fiberglass with foil face. Insulation shall meet requirements of NFPA 90A and tested to meet UL 181 erosion requirements. Hinged, insulated, and gasketed access doors shall be provided to allow full access to all refrigerant and control components for proper servicing and or replacement. Access doors shall be coordinated with the installation to allow proper clearances. Units shall be provided complete with supply and return duct flanges.
- C. Fan and Motor: Fan and motor assembly shall be direct drive, backward curved planum type fan designed to provide specified air volume at specified external static pressures. Fan motors shall be permanently lubricated and provided with internal thermal overload protection. Where units are indicated as Variable Air Volume (VAV), factory mounted and wired Variable Speed Drives shall be provided. Motors for use with variable frequency

drives (VFD) shall be rated for "VFD-duty", Inverter Duty, or shall be Premium Efficiency type with Class F (1500 volt) insulation and thermal overload protection.

- D. Refrigerant Piping: Units shall have a sealed refrigerant circuit including a high efficiency scroll, rotary or reciprocating compressor designed for cooling operation, a capillary tube assembly for refrigerant metering, and safety controls including a high pressure switch, low pressure switch (loss of charge), and coil low temperature sensor. Refrigerant circuit access ports shall be fitted with locking type tamper resistant caps in strict accordance with the IMC.
- E. Compressors: The compressor shall have an internal spring vibration isolation and sound muffling system. Compressor shall have internal thermal overload protection. Refrigerant to air condenser coil shall be leak tested to 200 PSIG pressure.
- F. Electric Heater: Electric heater shall be constructed of heavy-duty nickel chromium elements, internally wye connected for 480V. Staging shall be achieved through the unit controller. An automatic reset and single operation high temperature limit controller shall operate to break line power to the heater element. Heaters shall be individually fused from the factory. The unit shall meet all NEC and CEC requirements when properly installed. Provide power assemblies to provide single-point connection.
- G. Drain Pan: Drain Pan shall be constructed of corrosion resistant material and insulated to prevent sweating. Drain outlet shall be located at pan as to allow complete and unobstructed drainage of condensate. Drain outlet shall be connected from pan directly to IPT fitting.
- H. Filters: Filters shall be 2" thick MERV-13 fiberglass filters. All units shall be provided with filter rack and filters.
- I. Barometric Relief and Economizer Control: Provide barometric relief damper (field installed) pressure-operated, gravity-closing. Economizer shall be comparative enthalpy type and include field installed fully modulating 0-100% motor dampers with a minimum position setting, preset linkage, wiring harness with plug, and spring return actuator.
- J. Unit Controller: Unit controls for safe automatic controlled operation of the system shall be factory furnished, microprocessor based, installed, and coordinated to operate with the Control system and Sequences specified in Section 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC. Unit controller shall have provision for automatic control from and full communications with Trane building control systems.
- K. Roof Curb: Rooftop units shall be provided with factory fabricated curb suitable for vibration isolation rail. Curb shall consist of die formed galvanized steel sections. Curb shall be full perimeter type with gasketing provided for field installation between curb and unit base. Curb height shall be coordinated with the roofing system and shall be a minimum of 12" – 14" above the top of the roofing system. Curb shall be pitched to match the pitch of the roof such that the top of the curb is level without the use of shims or other similar devices. Unit curb shall fully encompass the unit perimeter.

- L. The system shall be completely charged with refrigerant and oil and shall be guaranteed to be free of leakage for one (1) year. Compressors shall have labor and material guaranteed to be free from defective materials or workmanship for five (5) years after final acceptance of the project.
- M. A factory-trained service mechanic shall test and check out the system for safe, controlled operation. One week before final inspection, a letter from the unit manufacturer's representative shall be submitted to the Engineer certifying that the system is performing safely and satisfactorily.
- N. Warranty: Unit shall be warranted to be free from defects in material and workmanship for a period of one year from the project final completion date. Motors shall be warranted by the motor manufacturer for a period of one year from the project final completion date. Motor-compressor shall be guaranteed for 5 years from the project final completion date.
- O. Convenience Outlet: Unit shall have a factory-wired 115V GFI convenience receptacle.
- P. Provide single point power connection and phase loss monitoring.

2.4 DUCTLESS SPLIT SYSTEM (HEAT PUMP) AIR CONDITIONERS (DSS-1 / ODU-1):

- A. General - Equipment and material specified under this heading shall be Trane Model indicated on drawings, furnished and installed by a certified representative of the unit manufacturer. System shall consist of condensing unit, air unit, refrigerant piping, and system controls. Each system shall be fitted and rated in accordance with ARI Standard 210.
- B. Condensing (outdoor) unit shall be single-zone commercial type complete with compressor-motor unit, direct expansion condenser coil, condenser fans, starters, controls, and piping enclosed in a galvanized steel, bonderized and coated paint finish cabinet recommended for outside installation. Condenser fans shall be horizontal or vertical discharge. Intake and discharge opening shall be safely guarded. Condensing unit controls and accessories shall provide automatic capacity modulation and condenser and evaporator pressure control for operation down to 0°F outside air temperature. Crankcase heater shall be provided. Unit shall be supported in accordance with manufacturer's installation instruction.
- C. Fan-coil unit shall be (wall mounted type complete with cooling coil, fan, fan motor, piping connectors, starters, electrical controls, condensate pump and hanging brackets. Cabinet shall be constructed of zinc coated steel; full insulated with inlet and discharge grilles. Filters shall be cleanable. Fan shall be direct drive, 3-speed, with adjustable discharge. Cooling coil shall be non-ferrous direct-expansion type. Drip pan under coil shall have connection for field installed condensate pump.
- D. Special Features, Options, & Accessories. In addition to the above, provide: Compressor cycle delay, high condensing temperature protection, overload protection, high pressure relief, liquid solenoid valve, crankcase heater, condensate pump alarm, low ambient cooling.

- E. Refrigerant lines shall be hard-drawn, dehydrated, and sealed copper tubing, sized and connected as recommended by the unit manufacturer. Suction line shall be insulated and effectively vapor sealed. Refrigerant circuit access ports shall be fitted with locking type tamper resistant caps in strict accordance with the IMC.
- F. Stand-Alone controls for safe automatic controlled operation of the system shall be provided. Units shall be provided with low-ambient controls for operation down to 0°F. The thermostat shall be wall mounted with 3 speed fan selector switch, and an auto/manual switch. Provide thermostat to limit cooling coil discharge air to 45°F or above.
- G. The system shall be completely charged with refrigerant and oil and shall be guaranteed to be free of leakage for one (1) year.
- H. The system shall be tested and checked out for safe, controlled operation. One week before final inspection, a letter from the unit manufacturer's representative shall be submitted to the Engineer certifying that the system is performing safely and satisfactorily. Compressors shall be guaranteed to be free from defective materials or workmanship for five (5) years after final acceptance of the project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Handle and install units and accessories in accordance with ARI 260 and the manufacturer's printed instructions.
- B. Coordinate indoor units location with lighting and ceiling system.
- C. Coordinate roof openings and locations with structural framing.
- D. Provide equipment rails as specified in Section 23 34 00, HVAC FANS for outdoor units mounted on the roof.

3.2 TESTS

- A. Perform tests and make reports in accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

END OF SECTION

SECTION 238200
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 CONDITIONS

- A. The applicable provisions of Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), are hereby made a part of this section and the Contractor is cautioned to read Section 23 00 00 carefully as items of work applicable to this section are included in Section 23 00 00.

1.2 DESCRIPTION OF WORK

- A. recessed electric ceiling heaters, recessed electric wall heaters, electric unit heaters, electric cabinet heaters, shut-off variable terminal boxes with electric reheat.

1.3 RELATED WORK

- A. Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).
- B. Section 23 09 00, INSTRUMENTATION AND CONTROLS FOR HVAC.
- C. Section 23 30 00, HVAC AIR DISTRIBUTION.
- D. Section 23 34 00, HVAC FANS.
- E. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.

1.4 SUBMITTALS

- A. In accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), furnish the following:
 - 1. Manufacturer's Literature and Data:
 - a. Horizontal Concealed Heaters (Electric)
 - b. Unit Heaters (Electric)
 - c. Cabinet Unit Heaters (Electric)
 - d. Shut-off Variable Air Volume Terminal Boxes (Electric Heat)
 - 2. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).

1.5 EXTRA MATERIALS

- A. Furnish one set of air filters for each unit where applicable.

PART 2 - PRODUCTS

2.1 HORIZONTAL CONCEALED HEATERS (ELECTRIC):

- A. Heaters shall be Trane Model as indicated on drawings or equal horizontal concealed unit. Unit shall include coil, chassis, fan and fan casing, fan board and motors. Steel parts exposed to moisture shall be galvanized. The fan board assembly shall include a quick-disconnect motor plug. The chassis structural frame shall be constructed of 18 gauge galvanized steel. The unit shall be acoustically insulated with closed cell insulation. Chassis shall contain flanged duct connections at front and rear of unit.
- B. Fan: Galvanized steel fan wheels shall be centrifugal forward-curved and double-width. Fan wheels and housing shall be corrosion resistant. Fan housing shall be constructed of formed sheet metal.
- C. Electronically Commutated Motors (ECM): All motors shall be brushless DC electronically commutated motors factory programmed and run tested in assembled units. The motor controller shall be mounted in a control box with a built-in integrated user interface and LEC tachometer. If adjustments are needed, motor parameters shall be adjusted through momentary contact switches accessible without factory service personnel on the motor control board. Motors shall soft ramp between speeds to lessen the acoustics due to sudden speed changes. Motors shall be operated at three speeds or at variable speed with factory supplied controllers. The motor shall choose the highest speed if there are simultaneous or conflicting speed requests. All motors shall have integral overload protection with a maximum ambient operating of 104 deg F and use permanently sealed ball bearings. Motors shall operate at plus or minus 10% of rated voltage on all speed settings.
- D. Electric Heat Coil – Single Stage: A single stage electric heating coil shall be provided as the total source of heat. Electric heat coils shall be open-wire type. The coils shall be nickel chromium element design. The electric heat shall operate at the same voltage as the unit with a single power connection. Factory mounted electric heat coils shall be UL listed and interlocked with the fan motor switch. A call for electric heat operation shall turn on the fan. Motor controls shall be synchronized with the fan operation to ensure safe operation. A transformer shall be supplied on any voltage unit, eliminating the need for field installed step-down transformer. Unit-mounted quiet magnetic relays shall be provided on all voltages. A line-break high temperature cutout with automatic reset shall be provided as an integral part of the elements to de-energize the electric heat in the event of a malfunction.
- E. Disconnect Switch: Unit shall be provided with a factory mounted non-fused disconnect switch.
- F. Filters: Filter shall be concealed from sight and easily removable. A 1" MERV 8 filter shall be provided in the unit.

2.2 UNIT HEATERS (ELECTRIC):

- A. Markel Model as indicated on drawings or equal. Furnish and install electric horizontal unit heaters of capacities and voltage as indicated on drawings. Heaters shall be U.L. labeled and approved.
- B. Casing shall be constructed of heavy gage furniture steel. It shall be phosphatized and completely dip painted with a heavy duty baked enamel.
- C. Motor shall be of the totally enclosed continuous fan duty sleeve bearing type equipped with built in thermal overload protection. Each unit shall be equipped with a combination fan guard/motor support resiliently mounted at four points to absorb any motor vibration. The fan motor shall be wired within the unit heater to the electric heating coil power supply, thus eliminating need for external motor starters or a separate fan motor circuit to the unit.
- D. Fan shall be of the direct drive, broad bladed propeller fan type that has been statically and dynamically balanced at the factory to eliminate vibration.
- E. Electric coil shall be of the finned steel sheathed type and shall have built in overheat protection.
- F. U.L. Label: The unit heater shall have a U.L. label attached to the unit heater.
- G. Louver: The unit shall be equipped with louvers for horizontal diffusion.
- H. Controls: The unit shall be controlled as shown on drawings. Thermostat location shall be as shown on drawings.

2.3 CABINET UNIT HEATERS (ELECTRIC):

- A. Furnish and install Markel Model as indicated on drawings or equal electric cabinet heater of capacity and voltage as indicated on drawings. The cabinet heater shall be floor mounted and shall be U.L. labeled and approved.
- B. The cabinet shall be constructed of heavy duty 16-gauge Zinc coated steel. The heater shall have removable front door for access to the control panel, elements, motor-blower assembly, filters and all internal components. The grill configuration shall be field convertible to any airflow configuration. The cabinet shall have a textured finish of two coats of powder coat epoxy.
- C. The heating elements shall be warranted for 1 year and shall be non-glowing design consisting of special high temperature resistance wire enclosed in an incoloy sheath to which steel fins are furnace brazed. The heating elements shall be located directly in front of the blower discharge air for uniform heating. They shall be mounted with a single anchor at one end to minimize effects of thermal expansion and contraction.
- D. The motor blowers shall be direct drive and resiliently mounted on rigid heavy gauge frame for quiet operation and long life. The motor shall be two-speed, shaded pole type, rated for the voltage specified. Each shall have built-in automatic reset overload protection

and life time lubricated. The motor shall be vented and mounted in the air stream to provide maximum cooling of the motor.

- E. Integral factory installed thermostat shall be tamper resistant, linear capillary type.
- F. Provide front return grille and top discharge grille cabinet configuration.

2.4 SHUT-OFF VARIABLE AIR VOLUME TERMINAL BOXES:

- A. Shut-off variable terminal boxes shall be Trane or equal. See Equipment Notes for applicable terminal boxes.
- B. Casing shall be 22-gauge galvanized steel with interior surface of unit casing acoustically and thermally lined with 1", 1.0 lb./cu. ft. matte face insulation with R-value of 3.85 that meets NFPA-90A, UL 181, and bacteriological standard ASTM C1338, G31 and G22. Insulation shall be fully encapsulated with no exposed edges.
- C. Primary air valve shall be a heavy gauge galvanized steel cylinder sized to fit standard round duct with integral electric actuator. Maximum leak rate 1 percent at 4 inches wg. inlet static pressure. Integral multiple point, averaging flow sensing ring to provide primary air flow measurement within +/- 5 percent of unit rated airflow with 1-1/2 diameters of straight duct upstream of unit. Integral flow taps and calibration chart provided on each unit. Damper blade shall be constructed of a closed cell foam seal that is mechanically locked between two 22 gauge, galvanized steel disks with permanent damper position indicator on the shaft and mechanical stop to prevent over-stroking.
- D. Electric coil shall be factory mounted on discharge outlet, U.L. Listed, resistance open-type heater with automatic safety devices for complete and safe operation. Electric heat shall be SCR.
- E. Outlet connection shall be Integral Outlet sheet metal connection at unit discharge to facilitate ductwork installation. All units shall be U.L. Listed and CSA approved.
- F. Boxes shall be provided with 24V transformers factory installed and wired to power damper actuator, fan control, and DDC controller.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Handle and install units in accordance with manufacturer's written instructions.
- B. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

- C. Locate variable air volume boxes to provide a straight section of inlet duct for proper functioning of volume controls. Straight duct distance shall be per manufacturer instructions.
- D. Locate concealed equipment above ceilings at elevations suitable for proper drainage of cooling coil condensate where applicable.

3.2 OPERATIONAL TEST

- A. Perform tests and make reports in accordance with Section 23 00 00, HEATING, VENTILATING AND AIR-CONDITIONING (HVAC), and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

END OF SECTION

SECTION 260100
BASIC REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the basic requirements of electrical installations and includes requirements common to all sections of Divisions 26, 27 and 28. It expands and supplements the requirements specified in sections of Division 1.
- B. Division 26 shall provide the electrical equipment, electrical wire, raceways and cable work and connections as required for complete and operable electrical systems as indicated in Division 26 Contract Documents. Refer to all other portions of these Contract Documents and apply to those portions of work relating to Electrical Work the same as if the Electrical Work was repeated herein in its entirety.
- C. Other Divisions of these Contract Documents will provide equipment that will require electrical connections - Division 26 shall coordinate with other Divisions and shall provide all necessary items and equipment for complete and code-compliant connections.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 SCOPE OF THE WORK

- A. Work included under this section shall include complete electrical systems as shown on the Contract Documents, which includes all of the specifications, drawings, addendums, accepted change orders and the Authority Having Jurisdiction (AHJ) compliances. Provide supervision, labor, material, equipment, machinery, plant, and other items necessary to complete the systems. Items of equipment may be specified in the singular; however, provide the number of items of equipment indicated in the Contract Documents and as required for complete systems.
- B. It is the intention of these Contract Documents to call for finished work, tested and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."
- C. Minor details necessary for the complete installation and operation of the systems shall be included.

- D. Any item that is shown on the drawings but not mentioned in the specifications, or mentioned in the specifications but not shown on the drawings, shall be considered as being both shown on the drawings and mentioned in the specifications and shall be provided.
- E. The entire work provided for in the specifications and indicated on the drawings is to be accomplished even though every item and minor detail for the proper installation and successful operation of the entire work may not be mentioned in the specifications or shown on the drawings.
- F. All materials and equipment shall be new and listed by Underwriters Laboratories, Inc.

1.4 PERMITS AND FEE

- A. The Contractor shall obtain and pay for all permits, bonds, licenses, and inspection certificates, and shall pay inspection fees and taxes, but permanent electrical utility fees shall be paid by the Owner.
- B. The Contractor shall file plans and prepare documents required to obtain approvals of the Authorities Having Jurisdiction (AHJ).

1.5 DRAWINGS

- A. Electrical drawings are diagrammatic and indicate general arrangement of systems and work included. Consult Architectural and Structural drawings for building construction details.
- B. Should there be any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, notify the Architect/Engineer and make modifications as directed.
- C. Where variances occur between drawings and specifications or within either document itself, include in the contract price the item or arrangement of better quality, greater quantity, or higher cost.

1.6 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications in Divisions 2 through 23 for rough-in requirements.
- B. Rough-in openings shall align vertically and horizontally with the building structure and shall be plumb.
- C. Verify door swings before roughing-in switch outlets.

1.7 ELECTRICAL INSTALLATIONS

- A. In addition to the requirements of the General Conditions, examine areas and conditions for compliance with installation tolerances and other conditions affecting performance of electrical work. Do not proceed with installation until unsatisfactory conditions have been corrected. Verify all dimensions by field measurements.
- B. Install material and equipment in accordance with manufacturer's written installation instructions, applicable requirements of the National Electrical Contractors Association (NECA) "Standard of Installation" and applicable requirements of National Electrical Code (NEC).
- C. Coordinate electrical equipment and materials installation with other building components.
- D. Arrange for chases, slots and openings in other building components to allow for electrical installations.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
- F. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Where housekeeping pads are required, they shall be minimum 4" tall and shall meet Division 3 specifications.
- G. Where mounting heights are not indicated, detailed or dimensioned, bring to the attention of the Architect immediately for resolution.
- H. Install electrical equipment with National Electrical Code (NEC) required clearances to facilitate maintenance and repair or replacement of equipment components. Connect equipment in such a way as to facilitate future maintenance, with minimum of interference with other items in the vicinity. Do not run any conduits across any designated rooftop walkways – if this is unavoidable, provide a removable platform or stairs to safely walk over the conduits.
- I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components. Do not block mechanical equipment access with raceways.
- J. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
- K. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

- L. All wiring connectors and terminals (including but not limited to wiring devices, breakers, disconnects, fuses, starters, etc.) shall be rated for not less than 75 deg. C. If connectors and terminals are provided that are rated for less than 75 deg. C., the electrical contractor shall incur all costs associated with upsizing conductors and conduits as required by the NEC for lower-temperature conductors.
- M. All damages incurred to new or existing electrical installations shall be immediately reported to the general contractor project manager and repaired by the contractor at no cost to Owner.
- N. Site-Applied Interior Paints and Coatings: Comply with low-emitting requirements in Division 01 Section "Indoor Air Quality Requirements."
- O. See Division 1 for BIM coordination drawing requirements. This must include coordination of cable tray with all above-ceiling elements, ensuring that ceiling tiles can be removed and at least 4" of space is left above trays for cable pulling.

1.8 PROTECTION

- A. Protect work against theft, injury, or damage. Carefully store material and equipment off the ground and under cover. Close open ends of work or equipment with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

1.9 EXCAVATION AND BACKFILLING

- A. Excavate to the depths required for the installation of electrical work. The Contractor shall be responsible for obtaining core drill sample information prior to receipt of bids to determine presence or absence of rock. After receipts of bids, no extras will be allowed for excavation of rock. Remove and properly dispose of excavated materials not required or suitable for backfill. Provide shoring as necessary to protect existing facilities, new work, and the safety of personnel. Make open cut excavation, except for short sections of trench which may be tunneled if conduit or duct can be properly installed and supported.
- B. Grade the bottom of trenches to provide uniform bearing and support for each section of conduit on undisturbed soil at every point along its entire length. Backfill trench over depths with sand, fine gravel, or loose, granular, moist earth and thoroughly tamp. Unstable soil that is incapable of properly supporting conduit shall be removed to stable soil and the trench treated as over depth.
- C. Existing utility lines to be retained, whether known or unknown, and uncovered during excavation operations shall be protected from damage during excavation and backfilling, and if damaged shall be restored to original condition.
- D. Do not backfill until all tests have been performed and the utility systems installed conform to the requirements of the Contract Documents. Carefully backfill trenches with clean earth, sand, and gravel or soft shale in 6-inch layers and thoroughly tamp

until the conduit has a cover of not less than 2 feet. Place the remainder of the backfill in the trench in 1-foot layers and tamp. Grade surface to reasonable uniformity and mound over trenches. Use compacted backfill for excavation under slabs on grade, building structures, concrete or asphalt paving, and driveway or parking areas.

- E. Check elevations of utilities entering and leaving building. When such elevations require excavations lower than footing levels, notify Architect and proceed as directed by him. Make excavations at minimum required depths in order not to undercut footings.

1.10 ACCESSIBILITY

- A. Furnish, for installation by others, access doors in every location necessary and as required by Code or equipment manufacturer recommendation, whether indicated or not, to allow working access to concealed electrical items which may require operation, inspection, maintenance, or adjustment. Access doors are not required in lay-in panel systems. See Division 8 for specification and installation requirements.
- B. Coordinate the final location of concealed equipment and devices requiring access with final location of access doors. Access unit shall be of adequate size and shall match the wall, floor and ceiling rating and construction type. Allow ample space for removal of all parts that will likely require replacement or servicing during the normal life of equipment.
- C. Prior to installation of equipment and materials requiring access doors, prepare, for review by the architect in ample time for proper coordination, one (1) set of architectural prints marked with size and approximate location of all access doors.

1.11 JOINT SEALANTS

- A. See specification 07 92 00 – Joint Sealants for all joint sealants required around conduit and/or cable penetrations through interior and exterior joints.

1.12 PENETRATION FIRESTOPPING SYSTEMS

- A. See specification 07 84 13 – Penetration Firestopping for all penetration firestopping systems required around conduit and/or cable penetrations through fire-rated assemblies.

1.13 CUTTING AND PATCHING

- A. This Article supplements sections of Division 1 for general requirements for cutting and patching and specifies the cutting and patching for electrical equipment, components and materials, to include removal and legal disposal of selected materials, components, and equipment.
- B. Do not endanger or damage installed work through procedures and processes of cutting and patching.

- C. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.
- D. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- E. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.

1.14 SLEEVES

- A. Locate sleeves during normal course of work. Provide sleeves for conduit larger than 1" passing through concrete floor slabs and concrete, masonry, tile, and gypsum wall construction. Sleeves shall not be provided for conduit running embedded in concrete or slab on grade. Sleeves through structural members shall be only as directed by Architect.
- B. All conduits passing through fire-rated walls or floors or ceilings shall have sleeve assemblies to maintain the fire rating of the wall or floor or ceiling. Pack between sleeve and conduit with U.L. Listed material to maintain wall or floor or ceiling rating. See Architectural drawings for locations of fire-rated walls, floors and ceilings.
- C. Sleeves shall be constructed of 20 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated.
- D. Fasten sleeves securely in floors or 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 from being forced into the space between pipe and sleeve during construction.

1.15 MOTOR AND ELECTRICAL WIRING

- A. Temperature control wiring, equipment control wiring, and interlock wiring necessary for the proper sequence of operation of mechanical equipment will be provided as part of the Mechanical Work. See Division 23 for instrumentation and control for HVAC, and for the complete definition of control wiring.
- B. Power wiring from the power source to the motor or equipment junction box, including wiring through starters, VFD's and safety switches shall be provided as part of the Electrical Work under Division 26.

- C. Power wiring from the power source to electric heating equipment, including wiring through contactors, safety switches and line voltage control devices shall be provided as part of the Electrical Work under Division 26.

1.16 QUALITY ASSURANCE

- A. Manufacturers: Where a list of manufacturers or a proprietary item is not specified, use manufacturers whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects utilizing material similar to that required for this project.
- C. Codes and Standards: Comply with applicable requirements of the following codes and standards.
 - 1. National Electrical Manufacturers Association (NEMA) Standards.
 - 2. 2020 NFPA 70 - National Electrical Code (NEC)
 - 3. 2019 NFPA 72 – National Fire Alarm and Signaling Code
 - 4. 2021 VUSBC – Virginia Uniform Statewide Building Code (VCC – Virginia Construction Code)
 - 5. 2021 IBC - International Building Code as adopted and modified by the VUSBC (VCC)
 - 6. 2021 IFC – International Fire Code
 - 7. 2021 NFPA 101 – Life Safety Code
 - 8. 2021 VECC – Virginia Energy Conservation Code
 - 9. 2010 Americans with Disabilities Act Accessibility Guidelines (ADAAG)
 - 10. 2010 ADA Standards for Accessible Design
 - 11. Institute of Electrical and Electronics Engineers (IEEE) Standards
 - 12. National Electrical Safety Code (NESC)
 - 13. Other applicable ANSI/NFPA & UL Standards as required for the project
- D. Provide material and equipment which is listed by Underwriters Laboratories, Inc. (UL) and which bears the UL label. This applies to materials and equipment for which UL Standards have been established and for which label service is regularly furnished. Assemble materials and equipment, for which no UL Product Category exists for the completed unit, with UL-listed components.

1.17 ELECTRICAL REQUESTS FOR INFORMATION (RFI's)

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 for RFI definitions, requirements, and procedures. RFI's shall be submitted as a digital file (pdf). Allow 5 business days for review of RFI's, starting from the date LPA, Inc. receives the RFI's.

1.18 ELECTRICAL SUBMITTALS

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 for submittal definitions, requirements, and procedures. Shop drawings shall be submitted

per specification section as a digital file (pdf); do not combine equipment from multiple specification sections into a single submittal. O&M manuals with warranties shall be submitted tabulated per specification section combined into a single digital file (pdf). Allow 10 business days for review of shop drawings & O&M manuals, starting from the date LPA, Inc. receives the submittals.

- B. Submittal of shop drawings, product data and samples will be accepted only when submitted by the General Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.
- C. Submittals that are not acceptable must be resubmitted until returned as approved by the engineer. If the third submittal is not approved, the contractor will be responsible for paying additional fees for subsequent reviews of submittals at a rate of \$200 per hour, and the specified item may be required to be provided at the engineer's discretion at no additional cost to the contract. Submittals will not be returned until payment is received.

1.19 BIDDING INSTRUCTIONS

- A. Products are generally specified by a performance specification and/or by manufacturer's name and model number or trade name.
 - 1. When specified only by a performance specification, the Contractor may use any manufacturer who meets the performance specification and applicable codes.
 - 2. When several products/manufacturers are specified together, then the Contractor has the option of using any product/manufacturer listed. The Contractor shall be subject to the requirements of paragraph 1.18 - ELECTRICAL SUBMITTALS. The Contractor's bid shall be compiled on the use of the listed products without exception. Substitutions will only be considered after the contract has been signed and shall be subject to the requirements of paragraph 1.20 - SUBSTITUTIONS.
 - 3. When several products/manufacturers are specified together and the system design is based on one of the listed products by specific model number(s) or catalog number(s), the Contractor has the option of using the one specific product or any product/manufacturer listed. However, when another listed product/manufacturer is used, the Contractor shall be responsible for determining that the product(s) are compatible with building design, electrical design, and mechanical design; are equal to the basis-of-design product in quality, appearance, construction and performance (including lamping and lenses for lighting fixtures); and will not necessitate design modifications by the Architect/Engineer. The Contractor's bid shall be compiled on the use of the listed products/manufacturers without exception. Substitutions will only be considered after the Contract has been signed and shall be subject to the requirements of paragraph 1.20 - SUBSTITUTIONS.
 - 4. When only one manufacturer's name is listed with the catalog number, this shall be the basis of the bid. The Contractor's bid shall be compiled on the use of the listed product(s) only. Substitutions will only be considered after the Contract

has been signed and shall be subject to the requirements of paragraph 1.20 - SUBSTITUTIONS.

5. A request for substitution shall be made in writing from the General Contractor only. Requests by distributors, manufacturers, or manufacturer's representatives will not be considered. Oral requests will not be considered. Request for deviations from product specifications will not be considered.
6. Request for substitutions will not be considered during bidding unless the specified product is discontinued.
7. If approval for a substitution is granted, samples shall be submitted if and as requested by Engineer.
8. Approval of substitutions prior to shop drawing submittal will not be granted.

1.20 SUBSTITUTIONS

- A. Any substitution to the basis of design light fixtures shall require complete photometric point-by-point calculations (at no additional cost to the contract) of all areas (rooms) the substitute light fixtures will be installed. The photometric calculations shall include substitute light fixture(s) and any non-substitute light fixture(s) where they are all in the same area (room). Architect/Engineer shall then review substitution cut sheets and photometric calculations to determine if the light fixtures are equal to the basis of design.
- B. Substitutions are understood to mean that the Contractor:
 1. Has personally investigated the proposed substitute and has determined that it is equal or superior in all respects, including appearance, to the item specified.
 2. Will provide the same guarantee for the substitution that he would for the equipment specified,
 3. Has coordinated the installation of the substitute, providing design modifications and changes as required for the work to be complete in all respects.
 4. Has coordinated the installation of the substitute with the General Contractor pertaining to changes required for the work to be complete with all trades (all changes shall be provided without additional cost to the contract).
 5. All required design modifications and/or changes shall be submitted with the shop drawings for the substitute equipment.
 6. Has coordinated with the light controls manufacturer to ensure substitution will work with specified light controls and sequence of operations.
 7. Has provided the amount of credit due the Owner if the substitution is accepted.
- C. The Architect/Engineer will indicate on which of these items the Contractor may submit shop drawings for review. The acceptance by the Architect/Engineer of any or all of those items listed by the Contractor for review shall not constitute an approval of the substitute but shall mean that the Contractor may then submit detailed shop drawings for review. When a request for substitution is granted, the Architect/Engineer will review shop drawings as follows:
 1. If shop drawings for the substitute equipment are marked "AMEND & RESUBMIT" on first submittal, the Contractor is allowed to resubmit for two additional reviews, unless the Architect/Engineer provides other instructions. If

after the third review, the substitute equipment is not accepted, the specified equipment shall be provided without any additional cost to the contract.

2. If shop drawings for the substitute equipment are marked "REJECTED – SEE REMARKS" at any submittal level, the Contractor shall stop any further submittals of any substitute equipment. The Architect/Engineer will not review any additional substitute equipment and the Contractor shall submit and provide the specified equipment without any additional cost to the contract.

1.21 SIMILAR PRODUCTS

- A. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, conductors, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners and similar items used in Work, except as otherwise indicated.
- B. Provide products which are compatible within systems and other connected items.

1.22 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power-operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Provide the manufacturer's nearest authorized servicing agency, address and emergency telephone number.

1.23 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications. Products shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.24 IDENTIFICATION

- A. Coordinate all room number designations with the final room numbers. Use final room numbers for all final documentation and display, including but not limited to, programming, alarm displays, annunciator displays, panelboard schedules, signage, labels, and engraved labels. The room numbers shall be as directed by the Owner and may not be the same as shown on Contract Drawings. Include final room numbers on the drawings for the Record Documents.

1.25 RECORD DOCUMENTS

- A. Refer to the sections of Division 1 for record document requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark Drawings to indicate revisions to lighting fixture and wiring device layout; conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned from column lines; distribution and branch electrical circuitry; fuse and circuit breaker sizes and arrangements; support and hanger details; concealed control system devices; panel schedules.
- C. Mark Contract Documents to indicate accepted substitutions, Change Orders and actual equipment and material used on the project.
- D. Within 30 days after the date of system acceptance, as-built record drawings of the following shall be provided to the Owner in accordance with energy codes
 - 1. Single-line diagram of the building electrical distribution system
 - 2. Floor plans indicating the location and area served for all electrical distribution equipment.
- E. Within 90 days after the date of system acceptance, as-built record drawings of the actual lighting and associated controls installations shall be provided to the Owner, including the location, luminaire identifier, and control & circuiting for each piece of lighting equipment, in accordance with energy codes

1.26 OPERATING AND MAINTENANCE DATA

- A. Refer to the sections of Division 1 for procedures and requirements for preparation and submittal of maintenance manuals.
- B. In addition to the information required by Division 1 for Maintenance Data, include the following information:
 - 1. Submittal data stating equipment rating and selected options for each piece of equipment requiring maintenance. Include description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
 - 3. Operations and maintenance manuals for each piece of equipment requiring maintenance. Include maintenance procedures for routine preventative maintenance and troubleshooting, disassembly, repair and reassembly, aligning and adjusting instructions. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label; the label shall include the

- title or publication number for the operation and maintenance manual for that particular model and type of product.
4. Servicing instructions and lubrication charts and schedules.
 5. Names and addresses of at least one qualified service agency for each piece of equipment or system.
 6. A complete narrative of how each system is intended to operate.
- C. For compliance with energy codes, provide a lighting equipment and controls operations and maintenance manual to the Owner within 90 days after the date of system acceptance. These manuals shall include the following:
1. Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.
 2. Operation and maintenance manuals for each piece of lighting equipment and lighting controls with routine maintenance clearly identified, including a recommended re-lamping program and a schedule for inspecting and recalibrating all lighting controls.
 3. A complete narrative of how each lighting control system is intended to operate, including recommended settings.
- D. Compile and assemble the manuals for Divisions 26, 27 and 28 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference. Only one copy of each manual needs to be submitted for engineer review.
- E. For the Owner's use, provide 2 copies of all O&M manuals, diagnostic tools, software and sufficient training for all electrical systems and their components (generator, fire alarm, lighting controls, digital meters, etc.).
- 1.27 WARRANTIES
- A. Refer to the sections of Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties for Divisions 26, 27 and 28 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each product or piece of equipment, including date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services. Only one copy of each warranty needs to be submitted for engineer review.
- 1.28 CLEANING
- A. Refer to the sections of Division 1 for general requirements for cleaning.
- B. Clean all panelboards, lighting fixtures, and lenses prior to final acceptance. Replace all inoperative LED boards and LED drivers.

1.29 SITE VISIT REPORTS

- A. Respond in writing to each item of discrepancy noted on all site visit reports.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of the low voltage power and lighting wiring. Extent of electrical wire and cable shall be as indicated and required for complete and operable electrical systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.
- B. Refer to other Division 7, Division 26 and Division 31 sections for requirements for penetration firestopping, requirements for electrical installations, grounding and bonding, raceway and boxes and earthwork.

1.3 REFERENCES AND CODES

- A. NEMA WC 70 - Standard for Non-shielded Power Cable 2000 volts or Less for the Distribution of Electrical Energy (2009).
- B. 2020 NFPA 70 - National Electrical Code

1.4 SUBMITTALS

- A. In accordance with sections of Division 1, furnish the manufacturer's literature and data showing each conductor and cable type and rating.
- B. If aluminum conductors are used, use the aluminum conductor sizes noted on the feeder schedules. Aluminum ampacities shall be equal to or exceed the ampacities of the specified 90 degree rated copper conductors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to Authorities Having Jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with applicable requirements of NFPA 70 (NEC) pertaining to the construction and installation of electrical wires and cables.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver wire and cable properly packaged in factory fabricated containers or wound on NEMA-specified wire and cable reels. Each coil or reel shall contain only one continuous cable without splices.
- B. Handle wire and cable carefully to avoid abrading, puncturing or tearing wire and cable insulation and sheathing. Ensure the dielectric resistance integrity of the wire and cable is maintained.
- C. Store wire and cable in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. General: Provide electrical conductors and cables of manufacturer's standard materials, as indicated by published product information, designed and constructed as recommended by manufacturer for a complete installation and for applications indicated.
- B. Line Voltage (100 to 600 volts): Provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F). All indicated conductor sizes in construction documents are based on copper except where specifically noted otherwise. Provide color-coding of conductors. Use factory applied colored insulation for conductors #6 AWG and smaller. Use colored self-adhesive vinyl tape for #4 AWG and larger at terminations and splices. For 208Y/120 volt or 120/240 volt delta systems, provide black for phase A, red for phase B, blue for phase C, and white for neutral. For 480Y/277 volt systems, provide brown for phase A, orange for phase B, yellow for phase C, and gray for neutral. Provide ground conductor color as required by the NEC.
 - 1. Provide factory-fabricated copper conductors of sizes, ampacity ratings, and materials for applications and services indicated. Provide conductors with Type XHHW or XHHW-2 or THHN or THWN-2 insulation with a minimum rating of 90 degrees C, which are the indicated conductors scheduled.
 - 2. Provide solid conductors for sizes #10 AWG and smaller. Provide stranded conductors for sizes #8 AWG and larger. Provide minimum conductor size of #12 AWG, larger where indicated.
 - 3. For 120-volt 15 amp and 20 amp branch circuits, use minimum 12 AWG up to 60 feet, 10 AWG for 61-95 feet, 8 AWG for 96-155 feet and 6 AWG for branch circuits longer than 155 feet. Conductors shall be same size for entire length of run, except if all outlets are in the same room (1200 square feet or less) the oversized conductors may be run only to the first outlet.

4. For 277-volt 15 amp and 20 amp branch circuits, use minimum 12 AWG up to 140 feet, 10 AWG for 141-220 feet and 8 AWG for branch circuits longer than 220 feet. Conductors shall be same size for entire length of run.
5. At Contractor's option, #4 AWG copper conductors and larger may be substituted with the equivalent aluminum conductors (#2 AWG and larger). Provide Aluminum Association 8000 Series aluminum conductors. All indicated conductor sizes in construction documents are based on copper except where specifically noted otherwise; if the contractor opts to use aluminum in the cases allowed above, re-size conductors and raceways as necessary. In no case will conductors greater than 750 MCM be permitted. Do not substitute aluminum where the manufacturer of the item being served allows only copper.
6. Cables: Provide UL-type factory-fabricated cables of materials and jacketing/sheathing as indicated below for services indicated. Re-size cable conductors based on equal to or greater equivalent 75 degree C rated copper conductors as scheduled if cables are used. Select cables with construction features which fulfill project requirements. At Contractor's option, the following cable types are acceptable where indicated:

a. Type "MC"--METAL-CLAD CABLE

7. Fire Alarm Circuits: Type THHN/THWN or THHN/THWN-2 in full metal raceway system where installed in concealed walls and ceilings or outdoors (above or below grade) in combination with power-limited signaling circuit cables where allowed by code. Where required provide plenum rated or fire-protective signaling circuit cables/assemblies in accordance with the instructions by the manufacturer.

2.2 CONNECTORS

A. General: Provide proper current-carrying material suitable for conductors used.

B. Line Voltage (100 to 600 volts):

1. Splices: Provide solderless, screw-on, reusable pressure cable type, 600 volt connectors for conductors #10 AWG and smaller constructed of corrosion-resistant steel or copper spring and a vinyl or plastic insulator which is temperature-rated 105 degree C and approved for copper conductors. Provide compression connectors for conductors #8 AWG and larger constructed of copper, copper alloy or aluminum.
2. Terminations: Provide compression-type terminations rated 600V and 105 degree C, constructed of tin-plated copper; serrated barrel; chamfered conductor entry. All compression terminations shall be applied using the manufacturer's recommended compression tool for the size of termination used. The terminations shall be of exact size to fit the conductors and shall be installed to bring uniform pressure on all sides of the joint and assure a permanent high-conductivity connection. Where terminations are supplied as standard material on equipment, contractor may elect to utilize such termination in lieu of those specified herein.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS, CABLES AND CONNECTORS

- A. Coordinate conductors/cable installation work, including electrical raceway and equipment installation work, as necessary to properly interface installation of conductors/cables with other work.
- B. Unless otherwise indicated, install individual conductors in raceways.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- D. Support cables according to NEC and cable manufacturer's instructions.
- E. Cables penetrating fire-rated elements shall be sealed according to Division 7.
- F. Type MC cable may be used in areas where permitted by NEC and local codes, but only for branch circuits above accessible ceilings and in stud walls. Only cables with 75 degree C rated insulation are permitted. Where running into a panel where the ceiling space is inaccessible, conduit shall be run from the panel to a junction box above the nearest accessible ceiling. Cables shall be run neatly in straight parallel runs with proper support and limited sag.
- G. Provide cables in plenum spaces in metallic raceways or with cable jackets approved for use in plenum spaces.
- H. Provide listed bushing or grommets where non-metallic-sheathed cables pass through openings in metal studs and other metal members in accordance with NEC 300.4. Where cables are installed at roof decking, follow requirements of NEC 300.4(E).
- I. Pull conductors simultaneously where more than one is being installed in same raceway.
- J. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- K. Use pulling means, including fish tape, cable, rope and basket weave conductor/cable grips, which will not damage cables or raceway. Remove and replace all conductors/cables with damaged jacket or insulation.
- L. Install splices at accessible outlet or junction boxes. Keep splices in underground junction boxes, hand holes, and manholes to an absolute minimum. Where splices are necessary, arrange to minimize the effects of moisture.
- M. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.

- N. When using aluminum conductors, all conductor ends shall be stripped of insulation carefully to avoid nicking the metal. Oxide-inhibiting compounds containing abrasive conducting particles shall be applied to the conductor and shall thoroughly penetrate spaces between strands prior to crimping of aluminum conductor connector.
- O. Where ground conductors are required to be run in same raceway as phase conductors, the ground conductor shall be run continuous throughout each circuit and the ground conductor pigtailed to the device to ensure ground continuity.
- P. Do not install a shared neutral on any circuit. Install capped neutral conductors in switch boxes where required by NEC 404.2(C).
- Q. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- R. Wiring at Outlets: Install conductors at each outlet with at least 6 inches of slack.
- S. AC cable is not allowed to be used.
- T. Comply with all emergency system wiring requirements in NEC 700.10.

3.2 INSTALLATION OF CONDUCTORS AND CABLES FOR POWER LIMITED CIRCUITS

- A. Wiring for signaling and power limited circuits may be run exposed in the following locations:
 - 1. Above accessible ceilings where not exposed to view.
- B. Provide signaling and wiring for power limited circuits in raceways in the following locations:
 - 1. In all locations not specifically listed above.
 - 2. Where concealed in inaccessible locations.
 - 3. In elevator equipment rooms and hoistways.
- C. Install exposed conductors or cable parallel and perpendicular to building surfaces, or exposed structural members, and follow surface contours where possible.
- D. Install conductors and cables in a neat and workmanlike manner.
- E. Support conductors and cables frequently to prevent excessive sag. Support a minimum of 6" above suspended ceilings. Do not support conductors or cables from conduit or other raceway.
- F. Parallel cable runs shall be installed adjacent to each other. Tie adjacent runs in neat bundles.

- G. Install conductors and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals.
- H. Provide conductors and cables in accordance with requirements of manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check low voltage installed conductors and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, test low voltage conductors and cables for electrical continuity, short circuits and grounds. Also, test conductor phase-to-phase and phase-to-ground.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements of electrical equipment operations for safety and to provide a low impedance path for possible ground fault currents. Extent of grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits and equipment.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to other Division 26 sections for conductors/cables, electrical raceways, boxes and fittings which are required in conjunction with electrical grounding and bonding work.

1.4 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to electrical grounding and bonding, pertaining to systems, circuits, and equipment. Particular attention is called to Article 250.
- B. U.L. Compliance: Comply with applicable requirements of UL Standards Nos. 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are U.L. Listed and labeled for their intended usage.
- C. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

1.5 SUBMITTALS

- A. Submit manufacturer's data on grounding and bonding products and associated accessories.

PART 2 - PRODUCTS

2.1 GROUNDING SYSTEMS

- A. General: Except as otherwise indicated, provide electrical grounding and bonding systems in accordance with the NEC, with assembly of materials including, but not limited to: conductors/cables, connectors, terminals (solderless lugs), compression connectors, mechanical connectors and/or exothermic process connections, grounding electrodes and bonding jumpers, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Contractor's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE and established industry standards for applications indicated.
- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors matching power supply wiring materials and sized according to NEC.

2.2 MISCELLANEOUS MATERIAL

- A. Bonding Jumper Braid: Copper braided tape constructed of 30 gauge bare copper wires and properly sized for indicated applications.
- B. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals and clamps for indicated applications.
- C. Ground Busbar: Provide ground busbar of 1/4" thick, tin-plated copper; 15 1/2"L x 4"W; tower mounting with nylon polyamide insulators and stainless steel brackets and bolts for a total stand-off height of 2"; predrilled with 19 pairs of 5/16" holes and 3 pairs of 7/16" holes.
- D. Grounding Electrodes (Rods): Steel with copper welded exterior, 3/4 inch diameter and 10 feet length.
- E. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials and bonding jumpers, as recommended by accessories manufacturers for type services indicated.
- F. Compression Connectors: Compression connectors shall be manufactured from pure, wrought copper in compliance with ASTM B187.
- G. Mechanical Connectors: Mechanical cast connectors shall be manufactured from a copper alloy of minimum 80% copper, according to ASTM B30.
- H. Field Welding: Comply with AWS Code for procedures, appearance, quality of welds and methods used in correcting welding work. Provide welded connections where grounding conductors connect to underground grounding electrodes. Welds shall utilize the exothermic process.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. General: Install electrical grounding and bonding systems required in accordance with manufacturer's instructions and applicable portions of the NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Provide insulated equipment grounding conductors in the same raceway with phase conductors for all feeders (panelboards, control centers and distribution transformers), motor circuits, branch circuits and site lighting. Ground conductors shall be continuous from the equipment to the ground bus of the switchboard, panelboard or control center serving the equipment.
- C. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system with other work.
- D. Drive each grounding electrode (ground rod) vertically in the soil such that a minimum 8'-0" of length is in contact with the soil with the upper end of the electrode a minimum 2'-0" below finished grade level, but below the permanent moisture level. Utilize an exothermic welding process to connect grounding conductors to the underground grounding electrodes and at other inaccessible or concealed locations.
- E. Install standard cable bonding jumpers with ground clamps on water piping to electrically bypass water meters, water heaters, insulated joints and any equipment which is likely to be disconnected for repairs or replacement, refer to NEC 250.53 (D) (1).
- F. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- G. Ground electrical service system neutral at service entrance equipment to grounding electrodes. Make ground connections in accordance with NEC and local utility company requirements. Bonding jumpers at the service shall comply with NEC 250.92.
- H. Site Lighting: Lighting poles and fixtures shall be grounded to a ground rod in the pole base and to the branch circuit equipment grounding conductor.
- I. Ground each separately-derived system neutral to effectively grounded metallic water pipe, effectively grounded structural steel member or separate grounding electrode.

- J. Connect together system neutral, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, wiring device ground connectors and plumbing systems. Particular attention is called to NEC 250.92, 250.97 and 250.98 for metal raceway bonding requirements. Ground cord-and-plug connected equipment in accordance with NEC 250.114.
- K. Provide a ground bar in each communication room and electric room where indicated. Ground bars shall be mounted with long dimension horizontal and with bottom of bar 12" above the finished floor. Ground each bar as noted on drawings.
- L. Provide a ground connection to each structural column at the footer to a ground rod (driven electrode). Bonding conductors shall be the same size as the grounding electrode conductor(s). Connection to steel columns and ground rods shall be exothermic welds.
- M. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug to ground bar or bus.
- N. Connect grounding electrode conductors to metallic cold water pipe and sprinkler main within 5 feet of the entrance point into the building using a suitably sized ground clamp, refer to NEC 250.68 (C) (1). Also bond gas piping, metallic water piping and metal structural members to system ground where applicable in compliance with NEC 250.104.
- O. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.
- P. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- Q. All ground connectors shall be designed for fault-duty loading and shall have the fault capacity of the maximum sized conductor for which it is designed.
- R. Bolt hole connectors and in-line splices shall accommodate only one conductor size. All other ground connectors shall be range taking.
- S. Structural steel and busbar ground connectors shall accommodate only one rigid member conductor.
- T. All ground connectors shall be provided with a corrosion-inhibiting compound preapplied to the contact surfaces. The compound shall be compatible with the conductors accommodated by the connector.
- U. All ground connectors shall be capable of being provided with tin plating, if required by the application.
- V. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten

connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

W. Compression and Mechanical Connector Marking:

1. All connectors shall be clearly and permanently marked with the following information:
 - a. Manufacturer's inspection symbol
 - b. Catalog number
 - c. Conductor accommodation(s)
 - d. Installation die index or die catalog number (compression)
 - e. Underwriters Laboratories Listing Mark
 - f. The words "Suitable for Direct Burial," or "Direct Burial," or "Burial" as specified per ANSI/UL467.
2. The smallest unit package shall contain the information listed under Y.1 and shall also include installation tooling.

X. Ground Connector Installation Using Compression and Mechanical Connectors:

1. Installation of connectors shall be made in accordance with the manufacturer's recommendations. The instructions typically include conductor preparation (cleaning, pre-crimp), installation tool and die selection, and application of the proper number of crimps.
2. Connectors shall be installable under all types of weather/field conditions without special safety precautions or procedures.
3. Connectors shall be installable without using or producing hazardous materials or by-products.

Y. Aluminum grounding conductors shall be terminated in accordance with NEC 250.120(B).

Z. Provide grounding test well where indicated on electrical site plan. Test well shall be located directly over a ground rod. Provide an in-grade recessed junction box with coverplate that reads "Ground", type T416C by Erico or equal. Where multiple connections are made, an Erico bus bar system, compression connectors and ground inspection well type T416A shall be used. Set top of well flush with finished grade. Fill with 1-inch maximum-size crushed stone or gravel. Connections at test wells shall use compression-type connectors or conductors and make exothermic weld connections between conductors and grounding rods.

AA. Provide labels on all ground electrode conductors and bonding conductors that indicate what they are connected to.

1. Main Service Ground Buss Bar:
 - a. Ground electrode conductor to Metal Underground Water Pipe ground electrode shall be labeled: "Water Main".
 - b. Ground electrode conductor to Metal Frame of Building or Structure ground electrode shall be labeled: "Building Steel".
 - c. Ground electrode conductor to Concrete-Encased ground electrode shall be labeled: "Concrete Encasement".
 - d. Ground electrode conductor to Ground Rod Triad ground electrode shall be labeled: "Ground Rods".
 - e. Ground conductor to Telecommunication Systems ground buss bar (located at the telecommunication services) shall be labeled: "Telecommunication Systems".
 - f. Ground conductor to Interior Gas Metal Piping shall be labeled: "Gas Piping".
 - g. Ground conductor to Interior Sprinkler Metal Piping shall be labeled: "Sprinkler Piping".
2. Test Wells: Provide labels of all ground conductors terminated within the test wells.

3.3 FIELD QUALITY CONTROL

A. Ground Connector Inspection:

1. Compression dies shall provide embossment of the connector upon successful installation. The embossed index shall match the marking on the installed connector.
2. Connector marking information specified above shall be legible after installation for inspector cross-reference.
3. Closed barrel connectors shall have inspection holes at the appropriate location to verify proper cable insertion.

B. Performance:

1. All system connectors shall be Listed by Underwriters Laboratories for direct burial in earth or embedment in concrete per ANSI/UL467 Standard for Grounding and Bonding Equipment.
2. Connectors shall be suitable for lightning protection applications. Listing to UL96 Lightning Protection Components is required on applicable items.

C. Upon completion of installation of electrical grounding and bonding systems, test ground resistance of rod, pipe or plate electrodes and ground test well with ground resistance tester. Where tests show resistance to ground is over 25 ohms, provide additional electrodes as listed by the NEC to reduce resistance to 25 ohms or less. Retest to demonstrate compliance. This test does not apply to supplementary grounding electrodes such as a ground rod provided for exterior lighting fixture poles.

3.4 O&M MANUAL

- A. Provide O&M Manual as specified in specification section 260100. Include both a paper copy and digital pdf copy of the O&M Manual.

3.5 COMMISSIONING

- A. Upon completion of ground system installation, commissioning agent will provide visual verification that grounding system at both the main ground bar in the main electrical room and the test well outside is metered to be at or below 25 ohms. If not, contractor will be required to provide additional ground electrodes and ground electrode conductors as listed by the NEC until the grounding resistance is at or less than 25 ohms.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the extent of supports, anchors, sleeves and seals for electrical equipment installations as indicated by drawings and schedules, as specified in the Division 26 sections and as required by the NEC.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to construction and installation of electrical supporting devices.
- B. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- C. U.L. Compliance: Provide electrical components which are U.L. Listed and U.L. Labeled.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment system supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear and pullout force to resist maximum loads calculated or imposed under this Project, with a structural safety factor of five times the applied force.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 1. Manufacturers:
 - a. Cooper B-Line; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Allied Support Systems; Power-Strut Unit.
 - d. GS Metals Corp.
 - e. Michigan Hanger Co., Inc.; O-Strut Div.
 - f. National Pipe Hanger Corp.
 - g. Thomas & Betts Corporation.
 - h. Unistrut; Tyco International, Ltd.
 - i. Wesanco, Inc.
 - j. Bridgeport Fittings, Inc.
 2. Finishes:
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes and bars; black and galvanized.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Mounting, Anchoring and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers:

- (1) Hilti, Inc.
- (2) ITW Construction Products.
- (3) MKT Fastening, LLC.
- (4) Simpson Strong-Tie Co. Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened Portland cement concrete with tension, shear and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers:

- (1) Cooper B-Line; a division of Cooper Industries.
- (2) Empire Tool and Manufacturing Co., Inc.
- (3) Hilti, Inc.
- (4) ITW Construction Products.
- (5) MKT Fastening, LLC.
- (6) Powers Fasteners.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch (38 mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise required by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps or Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers and other devices on slotted-channel racks attached to substrate.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 5 for site-fabricated metal supports.
- B. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps, and attachments to support conduit properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports in compliance with NEC requirements.

END OF SECTION

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of conduit, fittings and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise. Extent of raceway work is indicated by drawings and schedules and as required by the NEC.

1.2 RELATED DIVISIONS AND SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.
- B. Refer to other Division 7 and Division 26 sections for requirements for penetration firestopping, requirements for electrical installations, grounding and bonding and wiring devices and miscellaneous equipment.

1.3 REFERENCES AND CODES

- A. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publication pertaining to raceways.
- B. U.L. Compliance and Labeling: Comply with applicable requirements of U.L. Safety Standards pertaining to electrical raceway systems. Provide raceway products and components which have been U.L. Listed and labeled.
- C. Electrical Code Compliance: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to the construction and installation of raceway systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on floor boxes, raceways, surface metal raceways, cable tray, thru-wall/floor firestop device.

PART 2 - PRODUCTS

2.1 ALL RACEWAYS

- A. General: Provide complete assembly of all raceways, including but not limited to fittings, couplings, conduit bodies, underground raceway seals, service heads, expansion fittings, straps, hangers and other components and accessories as required to complete raceway system.

2.2 METAL RACEWAYS

- A. Rigid Aluminum Conduit: Rigid aluminum 6063 Alloy, T41 temper, conforming to ANSI C80.5. Provide factory-applied, closed-end thread protectors.
- B. Rigid Steel Conduit: Rigid steel, zinc-coated, threaded type conforming to ANSI C80.1. Provide zinc coating fused to inside and outside walls.
- C. Intermediate Metal Conduit (IMC): Rigid intermediate grade steel, hot-dip galvanized conforming to ANSI C80.6.
- D. Electrical Metallic Tubing (EMT): ANSI C80.3. The Contractor has the option of using aluminum EMT where sizes 2" through 4" are required, except where UL firestop assemblies require steel.
- E. PVC Externally Coated Rigid Steel Conduit: Rigid steel zinc-coated with additional external coating of PVC conforming to NEMA RN 1.
- F. Flexible Metal Conduit: Formed from continuous length of spirally wound, interlocked zinc-coated strip steel conforming to UL 1.
- G. Liquid-Tight Flexible Metal Conduit: Constructed of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- H. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated, compatible with conduit materials conforming to NEMA FB-1.
- I. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
 - 1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - 2. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- J. Liquid-Tight Flexible Metal Conduit Fittings: Cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated throat.
- K. EMT Fittings: Galvanized steel fittings, set screw or compression watertight type, except where aluminum EMT is used provide UL listed fittings for use with aluminum EMT.

- L. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded-conduit-entrance ends, removable covers, either cast or of aluminum or galvanized steel, and corrosion-resistant screws.

2.3 NON-METALLIC RACEWAYS

A. Electrical Plastic Conduit:

1. Heavy Wall Conduit: Schedule 40, 90 deg. C, UL-rated, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or normal above ground use, UL-listed and in conformity with NEC Article 352.
2. Extra Heavy Wall Conduit: Schedule 80, UL-rated, constructed of polyvinyl chloride compound C-200 PVC conforming to NEMA TC-2, and UL-listed in accordance with NEC Article 352 for direct burial, or above ground use.

B. PVC Conduit and Tubing Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.

C. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials complying with manufacturer's published product information, which mate and match conduit and tubing.

D. Conduit and Fitting Bonding: Use only manufacturer's recommended sealing compounds to produce watertight joints.

2.4 WIREWAYS

A. General: Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as required for a complete system.

B. Lay-in Wireways: Construct lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing screws. Provide wireways with knockouts.

1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.
2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

C. Raintight Wireway: Construct raintight lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of

sealing cover in closed position with sealing screws. Provide wireway units with knockouts only in bottom of wireway.

D. Raintight Troughs: Construct in accordance with UL 870, with components UL-listed.

1. Construction: 16-gauge galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-gauge parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation, or would compromise raintight capability of the trough. Do not use cover screws that protrude into the trough area and damage wire insulation.
2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.5 CABLE TRAY

A. Cable Tray: Shall be aluminum ladder type as follows:

1. Cable tray shall be nominal 4 inches high and lengths and widths as indicated on drawings.
2. Cable trays shall not have any sharp edges that can cut or damage cable jackets or conductors while being installed (pulled) over the cable tray assemblies.
3. Provide cable tray splices, radius drops or rises, bends, supports, connectors and fittings for a complete wireway system.
4. Provide Cooper B-Line or approved equal.

2.6 SURFACE METAL RACEWAYS

- A. Type SR1 Raceway: Two-piece type with single compartment, length as indicated. Provide nominal 1-1/4" x 7/8" with flush, snap-on cover. Install devices as indicated in raceway.
- B. Type SR2 Raceway: Two-piece type with single compartment, length as indicated. Provide nominal 2-3/4" x 1-15/32" with flush, snap-on cover. Install devices as indicated in raceway.

2.7 SURFACE RACEWAY ADDITIONAL REQUIREMENTS

- A. Provide all boxes, fittings and mounting accessories required for surface raceways; designed, manufactured and supplied by raceway manufacturer for use with specified raceway.
- B. Manufacturers: Provide surface raceways of one of the following:
1. Panduit Corp.
 2. Wiremold Company.
 3. Monosystems.

- C. Submit color samples for selection with shop drawings where requested by Architect or Owner.

2.8 OUTLET BOXES

- A. Provide galvanized coated flat rolled sheet-steel non-gangable outlet boxes, of shapes, cubic inch capacities, and sizes suitable for installation at respective locations. Provide one piece multiple-gang boxes, not built-up. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom, ends and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover, and with grounding screws for fastening surface and device type box covers, and for equipment type grounding.
- B. Outlet Box Accessories:
 - 1. Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Contractor's code-compliant option. Provide Erico #RBS16 or RBS24 box mounting plate in metal or wood stud partition walls as required where two or three devices are shown mounted side by side such as a receptacle, telecom or other device as indicated.
 - 2. Provide outlet box extension rings of the square-cut tile-type for use in GWB, tile, and wood-paneled walls. Provide standard plaster rings for use in plaster walls.
- C. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet boxes, of types, shapes and sizes suitable for installation at respective locations, with threaded conduit holes for fastening electrical conduit, complete with NEMA 3R covers.

2.9 INTERIOR AND ABOVE-GRADE EXTERIOR JUNCTION AND PULL BOXES

- A. Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation. For exterior above-grade locations, provide NEMA 3R boxes with welded seams and equipped with stainless steel nuts, bolts, screws and washers. If knockouts are provided on the sides of the box for conduit entry, use watertight conduit hubs. Large pullboxes with any dimension over 6 feet shall be complete with built-in wire support systems to prevent wire from pressing on connectors or other wire to prevent damage to insulation. Pullboxes in high-rise installations shall be complete with insulating wedge type connectors to provide proper support of conductors. The number and locations of pullboxes shall be as required by NEC to provide proper support of conductors, where required due to the number of bends in the raceway and where required due to length of raceway to not exceed the maximum pulling tension recommended by the cable manufacturer. Exterior exposed pullboxes shall be provided with screened raintight openings to allow heat to escape.

2.10 EXTERIOR BELOW-GRADE JUNCTION AND PULL BOXES

- A. Provide exterior below-grade junction and pull boxes at locations indicated and as required. Top of boxes shall be set flush with existing grade. Boxes shall be constructed of polymer concrete and fiber reinforced polyester 3 to 4 times the compressive strength of concrete and having the tensile strength of steel. Boxes shall have full size covers secured to the box with stainless steel pentahead hardware. Covers shall have the logo "ELECTRIC" or "TELECOM" as required. Boxes and covers shall have a heavy duty rating. Boxes shall be sized in accordance with NEC requirements for number of conduits entering and leaving box.

2.11 GENERAL FLOOR BOXES

- A. Corrosion-Resistant Recessed Service Floor Boxes: Provide corrosion-resistant, for use in concrete, watertight floor boxes, 3-3/4" deep, fully adjustable before and after the concrete pour. two or four-gang combinations, as noted below, where indicated on the drawings. Provide boxes with rectangular covers, and complete with threaded conduit entrances, vertical adjusting rings, gaskets, aluminum (color finish to be selected by architect) cover plate with cover screws to match plates. Provide rectangular cover plate with two large cable egress doors and access 180 degree opening with combination carpet and tile flange where carpet or tile is indicated on finish schedule. Boxes shall accept industry standard and proprietary telecom connectivity devices. Wiring devices shall be as specified in Section 26 27 26.
 - 1. Type F1 Floor Box: Combination Receptacle/Telecom Four-Gang Floor Box: Provide a four-gang floor box complete with two duplex receptacles, barrier between power and communications sections, two 6-port keystone jacks. Floor Box shall have a minimum of (2) 1-1/2" knock outs for Communication Conduit and (2) 1" knockouts for Power Conduit.
- B. Manufacturers: Provide floor boxes of one of the following:
 - 1. Hubbell
 - 2. Steel City
 - 3. Wiremold Company

2.12 MISCELLANEOUS CABINETS

- A. Provide flat-rolled sheet-steel cabinets, flush or surface mounted as indicated, hinged door with flush latch and lock. Provide a framed directory with clear plastic protective cover on inside of door; trim clamps; gaskets where required by atmospheric conditions; single point latching for doors under 36"; 3 point latching for doors 36" and larger. Door and trim shall have factory applied finish to match panelboard cabinets.
- B. Fabricate C.T. cabinets from 12 gauge sheet steel; double doors with 3-point latching; NEMA-1 for interior cabinet and NEMA-3R for exterior cabinet enclosure, gray enamel finish inside and out over phosphatized surfaces; 3/4" thick full size plywood panel installed in cabinet; hasp and staple for padlocking or sealing by the utility company.

C. Manufacturers: Provide cabinets of one of the following:

1. Anchor
2. Austin
3. Keystone
4. Electromate
5. Hoffman
6. Westinghouse
7. General Electric
8. Square D

2.13 THRU-WALL/FLOOR FIRESTOP DEVICE

- A. The firestop device shall meet UL1479 (ASTM E 814) and bear the U.S. UL Classification Mark. The device shall be classified for use in one-, two-, three-, and four-hour rated gypsum, concrete and block walls. The device shall also have been listed by Underwriters Laboratories Inc. To UL2043 and determined to be suitable for use in air handling spaces. The firestop device shall stop or inhibit the spread of both fire and smoke as required by the VCC for fire and smoke rated partitions and barriers.
- B. Sizes: The firestop device shall be for 2" and 4" trade size EMT conduit.
- C. At each location where conduits and/or sleeves penetrate a fire or smoke rated partition or barrier for a pathway for I.T. cables, provide sufficient quantity of units to completely cover and properly seal all conduits and sleeves.
- D. Installation shall be in strict accordance with
1. Manufacturer's installation instructions.
 2. All written and graphic requirements in the test assembly documentation published by the listing agency.
- E. The firestop device shall be by Wiremold FlameStopper, Hilti Speed Sleeve, or STI EZ-Path.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS

- A. Install raceways level and plumb, and maintain manufacturer's recommended clearances.
- B. Coordinate with other work including wires/cables, boxes and panel work as necessary to interface installation of electrical raceways and components with other work.

3.2 INSTALLATION OF CONDUITS

- A. Conduit runs are not shown on floor plans unless specifically noted or indicated otherwise.
- B. Applications:
 - 1. Use rigid steel conduit in moist or damp locations, in hazardous or refrigerated areas, in poured concrete, underground, beneath slab-on-grade and where exposed outdoors.
 - 2. Steel IMC may be used in lieu of rigid steel conduit where permitted by the NEC, except IMC may not be used below-grade, below slab or in slab.
 - 3. EMT may be used for all installations not requiring rigid or IMC conduit. Aluminum EMT may be used at Contractor's option for size 2" through 4", except do not use aluminum EMT or aluminum products in cast-in-place concrete installation or where UL firestop assemblies require steel..
 - 4. Rigid conduit may be steel or aluminum at Contractor's option, except do not use aluminum conduit or aluminum products in cast-in-place concrete installations or where UL firestop assemblies require steel..
 - 5. Rigid PVC conduit may be used in lieu of rigid steel for conduits installed in poured concrete, underground or beneath slab-on-grade. Convert to metallic conduit at no more than 48" above ground or slab if concealed in wall; otherwise, convert to metallic conduit before exiting ground or slab. Do not use PVC conduit above-grade unless specifically indicated otherwise.
 - 6. Use PVC-coated rigid conduit and fittings in all highly-corrosive atmospheres.
 - 7. Use flexible conduit in movable partitions, from outlet boxes to recessed lighting fixtures, and in cells of precast concrete panels.
 - 8. Use liquid-tight flexible conduit in exterior exposed locations; in moist or humid atmosphere where condensate can be expected to accumulate; in corrosive atmosphere; where subjected to water spray or dripping oil, water or grease; and for connection of motors, transformers and equipment subject to movement and vibration. Wherever liquid-tight flexible conduit is used, it may only be for the final 6 feet (maximum) of a connection to a motor, transformer or piece of equipment subject to movement or vibration.
 - 9. Do not install any EMT conduit outside of the exterior walls within the exterior brick cavity. All EMT conduits shall be routed within exterior walls.
- C. General:
 - 1. Install conduits concealed in new construction work, either in walls, slabs or above hung ceiling, except in mechanical or electrical equipment rooms in which they may be exposed. Install conduits concealed in stairs, except in stairs without suspended ceilings a short horizontal section conduit to feed each light fixture mounted to underside of landing may be exposed. Run conduits concealed in existing work where practicable. Where conduits cannot be concealed in finished areas, notify the Architect and Owner for permission to use surface raceways. Where installed at roof decking, follow requirements of NEC 300.4(E).

2. Provide penetration firestopping systems in smoke barriers and fire-resistance-rated walls, floors and ceilings for electrical raceway penetrations in accordance with specification 07 84 13 – Penetration Firestopping.
3. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
4. Avoid use of dissimilar metals throughout systems to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
5. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion/deflection fittings in raceways every 200' linear run or wherever structural expansion joints are crossed, per NEC 300.4(H).
6. Provide polypropylene or monofilament plastic or pull cord with not less than 200-lb tensile strength in empty conduits, tied off at both ends. Test conduits required to be installed, but left empty, with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
7. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
8. Use factory-made elbows or field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
9. Size conduits to meet NEC, except no conduit smaller than 1/2 inch shall be used unless noted otherwise. Conduits below-grade and in-slab shall be minimum 1 inch.
10. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
11. Conduits shall not touch sprinkler pipes, or cross pipe shafts or ventilating duct openings.
12. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes and other sources of heat. Wherever possible, install raceway runs below hot water and steam piping where necessary to cross piping.
13. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
14. Complete installation of electrical raceways before starting installation of cables/wire within raceways.
15. Install conduits so as not to damage the integrity of the structural members. Avoid horizontal or cross runs in building partitions or side walls.
16. Install temporary closures to prevent foreign matter from entering raceways.
17. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
18. Provide bushings on all conduit stubs.

D. Concealed Conduits:

1. Metallic raceways installed underground, in floors, below-grade or outside shall have conduit threads painted with corrosion inhibiting compound before

couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.

2. Install underground conduits minimum of 24" below finished grade, except where NEC requires deeper burial.
3. Mark Record Documents with conduit size and location.

E. Conduits in Concrete Slabs:

1. Install conduits in concrete slabs only under the following conditions:
 - a. In slab-on-grade.
 - b. In structural concrete deck.
 - c. In concrete-on-metal deck for short runs to isolated floor outlets.
2. Place conduits between bottom reinforcing steel and top reinforcing steel in middle 1/3 of slab thickness. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond. Conduits crossing in slab must be reviewed for proper cover by Architect. Minimum finished cover of conduit in slabs shall not be less than one inch. Embedded conduit diameter is not to exceed 1/3 of slab thickness at cross-overs, if any. For locations where a large "swath" of conduits will be in or below slab, coordinate requirements with Structural Engineer before rough-in.
3. Mark Record Documents with conduit size and location.

F. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems parallel with or at right angles to walls and floors of building. Conduits shall be run tight to the wall and ceiling or structure and as neatly and inconspicuously as possible.
2. Exposed conduits may be used in finished spaces only when conduits cannot be concealed and surface raceway is not practical, and only with the specific approval of the Architect and Owner. The Contractor shall submit a detailed proposal for the area and the routing of the exposed conduit to the Architect before installation. Exposed conduits in finished areas shall be painted to match the surface on which they are installed.
3. Install exposed conduit work so as not to interfere with ceiling inserts, lights, ventilation ducts, HVAC unit clearances, or outlets.
4. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed the requirements of the NEC. Support multiple runs of conduit from trapeze hangers.
5. Set anchors in waterproof cement for the support of conduits where run on waterproof walls.
6. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings and in crawl spaces.

G. Non-metallic Conduits: Make solvent cemented joints in accordance with recommendations of manufacturer.

H. Conduit Fittings:

1. Use locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Bushings for terminating conduit smaller than 1-1/4" shall have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
3. Install insulated type bushings for terminating conduits 1-1/4" and larger. Bushings shall have flared bottom and ribbed sides. Upper edge shall have phenolic insulating ring molded into bushing.
4. Bushings of standard or insulated type shall have screw type grounding terminal where required by the NEC.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs shall be specifically designed for their particular application.
6. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with U.L. Listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where otherwise required by NFPA 70, such as in 225.27 and 300.5(G).

3.3 INSTALLATION OF WIREWAYS AND SURFACE METAL RACEWAYS

- A. Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets in order to provide effective electrical continuity and rigid mechanical assembly.
- B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
- C. Install expansion fittings in all wireways and raceways wherever structural expansion joints are crossed.
- D. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
- E. Properly support and anchor raceways for their entire length by structural materials. Raceways shall not span any space unsupported.
- F. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.

3.4 INSTALLATION OF CABLE TRAYS

- A. Individual sections of cable trays shall be evenly aligned and secured together in a way to keep the hardware from damaging the jacket and conductors of the cable and to keep sections of cable trays from separating away from each other.
- B. Cable trays shall be supported uniformly from wall or structure overhead, capable of supporting the total weight of the cables and cable trays (approximately 40 to 50 pounds per foot) as detailed by the manufacturer of the cable tray.
- C. Cable trays shall be suspended above the drop ceiling and allow for the removal of acoustical ceiling tiles. Provide minimum 4" clearance above cable tray to piping, ductwork and other items to allow cables to be added to or removed from tray. Keep trays at least 6" away from lighting fixtures.
- D. The Contractor shall provide all materials, labor, and equipment and supervision necessary to install the cable trays of route and length as indicated on the contract drawings.
- E. Cable trays shall be run in a horizontal plane where possible. Provide all components and transition sections as required to offset cable trays horizontally and/or vertically to fully coordinate with all ceiling components.
- F. Provide penetration firestopping in smoke barriers and fire-resistance-rated walls, floors and ceilings for cable tray penetrations in accordance with Division 7 and this specification.
- G. Install expansion connectors where cable tray crosses building expansion joints and in cable tray runs that exceed 90 feet (27 m). Space connectors and set gaps according to NEMA VE 1.
- H. Ground cable trays according to manufacturer's written instructions.
- I. Follow all requirements of NEC Article 392.

3.5 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. All wall-mounted wiring device boxes shall be mounted with long dimension vertically unless otherwise noted.
- B. Coordinate installation of electrical boxes and fittings with conductors/cable, wiring devices, raceway installation work, and equipment requiring electrical connections.
- C. Provide raintight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide surface mounted boxes only where recessed mounting is not possible.

- E. Provide knockout closures to cap unused knockout holes where blanks have been removed in new and existing boxes and fittings.
- F. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.
- G. Do not install boxes back-to-back in walls.
- H. Provide not less than 6" separation between sides of boxes in opposite sides of acoustic walls, unless "putty pads" are provided for sound attenuation.
- I. Provide membrane protection for penetrations of fire horizontal assemblies:
 - 1. Through penetrations shall be protected using systems installed as tested in the approved fire-resistance-rated assembly, or
 - 2. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an F rating of not less than the required fire-resistant rating of the wall penetrated.
- J. Provide membrane protection for penetrations of fire rated ceiling assemblies:
 - 1. Through penetrations shall be protected using systems installed as tested in the approved fire-resistance-rated assembly, or
 - 2. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an F rating/T rating of not less than 1 hour but not less than the required rating of the floor penetrated.
- K. Do not install aluminum products in concrete.
- L. Position recessed outlet boxes accurately in order that boxes will not be installed with front edge of box at a greater depth in wall than permitted by NEC. Provide extension rings for existing outlet boxes with new wall covering so face of box is flush with the finished wall surface and finished plate is tight to wall on all sides.
- M. Set floor boxes level and flush with finish flooring material. Trim as necessary after installation to fit flush with finished floor surface.
- N. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Box support shall be independent of conduit.
- O. Subsequent to installation of boxes, protect boxes from construction debris and damage.

- P. Install power and communications outlets for televisions so as to be concealed by the television. Coordinate location with the bracing for wall or ceiling brackets and with furniture as recommended by manufacturer.

3.6 O&M MANUAL

- A. Provide O&M Manual as specified in specification section 260100. Include both a paper copy and digital pdf copy of the O&M Manual.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Extent of electrical identification work is as herein specified.
- B. Types of electrical identification work specified in this section include the following:
 - 1. Electrical power, control, fire alarm and communication conductors and/or conduits.
 - 2. Operational instructions and warnings.
 - 3. Danger signs.
 - 4. Equipment/system identification signs.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to installation of identifying labels and markers for wiring and equipment.
- B. U.L. Compliance: Comply with applicable requirements of UL Std. 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Std. Nos. WC-1 and WC-2 pertaining to identification of power and control conductors.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams and the manuals, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.

- D. Install identifying devices before the installation of acoustical ceilings and similar concealment.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical identification materials and products.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Contractor's option, but provide single selection for each application.
- B. Color-Coded Plastic Tape: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1/2" wide.
- C. Detectable Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed detectable plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.
- D. Self-Adhesive Plastic Signs:
 - 1. General: Provide manufacturer's standard self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings, of sizes suitable for application areas and adequate for visibility, with proper wording for each application.
 - 2. Colors: Unless otherwise indicated, or required by governing regulations, provide black signs with white lettering.
- E. Baked Enamel Danger Signs: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gage steel with standard red, black and white graphics. Provide following minimum sizes: 20" x 14", 14" x 10", or 10" x 7", where signs are sized according to the largest size which can be applied where needed, or where a larger size is needed for adequate vision. Provide signs with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.
- F. Cable/Conductor Identification Bands: Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap, numbered to show circuit identification.

G. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thickness indicated, engraved with engraver's standard lettering style of sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate, and color codes as indicated below:
 - a. Equipment Power Systems: Black face with White lettering.
 - b. Life Safety Power Systems: Yellow face with Black lettering.
2. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.2 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operations/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install electrical identification products as specified in accordance with the manufacturer's written instructions and the requirements of the NEC.
- B. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of finish work.
- C. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- D. Identification: Coordinate all room number designations with the final room numbers. Use final room numbers for all final documentation and display, including but not limited to, programming, alarm displays, annunciator displays, panelboard schedules, signage, labels and engraved labels. The room numbers shall be as directed by the Owner and may not be the same as shown on Contract Drawings. Include final room numbers on the drawings for the Record Documents.

3.2 CONDUIT IDENTIFICATION

- A. Where conduit is concealed above accessible ceilings or exposed, apply color-coded identification at equipment termination, at outlet boxes, pull boxes and junction boxes, within each room, and at 20' on-center within an area.

1. Color-code conduit using plastic tape with the following band colors between orange background bands.

SERVICE	COLOR BAND
240 or 208/120 Volt Life Safety Emergency Circuits	Black/Yellow
240 or 208/120 Volt Equipment Emergency Circuits	Black/Red
480/277 Volt Life Safety Emergency Circuits	Blue/Yellow
480/277 Volt Equipment Emergency Circuits	Blue/Red
Grounding Electrode	Green
Fire Alarm	Red
Sound/Intercommunication	Purple
Television	Brown
Telephone	Yellow
Telecom	Brown/Yellow
Security	White/Red

2. Fire Alarm box lids and couplings shall be red in color, confirm with local AHJ that is all that is required to be red in color for fire alarm raceways.

3.3 UNDERGROUND CABLE IDENTIFICATION

- A. During backfilling/top-soiling of each exterior underground electrical, signal or communication cable, install a continuous detectable underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker. Install line marker for every buried cable or group of buried cables, regardless of whether direct-buried or protected in conduit.

3.4 CONDUCTOR/CABLE COLOR CODING

- A. See Division 26 for color-coding of line voltage conductors and cables. Provide means of identification per NEC 200.6(D).

3.5 CONDUCTOR/CABLE CIRCUIT IDENTIFICATION

- A. Apply cable/conductor identification, including panelboard and circuit number on power wiring, on each cable/conductor in each box/enclosure/cabinet. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.6 IDENTIFICATION OF UNGROUNDED CONDUCTORS

- A. Where more than one nominal voltage system exists in a building, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system. This means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means and shall be permanently posted at each panelboard and switchboard or readily available in accordance with NEC 210.5.

3.7 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. Operational Identification and Warnings: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets, and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

3.8 DANGER SIGNS

- A. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations identified by Installer of electrical work as constituting similar dangers for persons in or about project.
- B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
- C. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger of persons, or damage to or loss of property.

3.9 EQUIPMENT/SYSTEM IDENTIFICATION

- A. Signs: Install engraved plastic-laminate sign on outside of each major unit of electrical equipment in building, including central or master unit of each electrical system, including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide three (3) lines of text, with 1/2" high lettering for first line and 1/4" high lettering for other lines; first line of text shall indicate name of unit, second line of text shall indicate voltage and phase and number of wires, and third line of text shall indicate origin of feeder. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
 - 1. Panelboards, control panels, relay panels, electrical cabinets, and enclosures.
 - 2. Access panel/doors for concealed electrical items.
 - 3. Enclosed switches (safety switches) and circuit breakers.
 - 4. Motor starters (magnetic and manual starters).
 - 5. Variable frequency drives.
 - 6. Automatic transfer switches.
 - 7. Transformers.
 - 8. Push-button stations.
 - 9. Time clocks and lighting contactors.
 - 10. Power generating units.

- 11. Provide permanent SERVICE ENTRANCE label for all service entrance equipment.
 - B. Special Service Signs: Install signs or plaques at the location of each main service equipment location, including existing and new locations, as indicated and as required by NEC or local codes.
 - C. Provide identification, labeling and signs for emergency and standby systems as required by 700.7, 700.10, 701.7 and 702.7 of NEC.
 - D. Install signs at locations indicated and, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment.
 - E. Provide labeling in accordance with all requirements in NEC 110.21 and 110.22.
 - F. Provide fault current labeling on service equipment per NEC 110.24(A).
 - G. Provide enclosure type labeling as required in NEC 110.28.
 - H. Where transformer disconnecting means are remote from the transformer, the disconnect location shall be permanently marked on the transformer.
 - I. Provide label on each fire alarm control panel and power supply clearly indicating the branch circuit feeding it. Provide another label on each fire alarm control panel and power supply that indicates the room location of the panelboard that is powering the fire alarm control panel and power supply.
 - J. Provide labeling on all wiring devices (receptacles and lighting controls) with the panel and circuit number feeding them. Place the label on the cover plate. For all floor boxes, locate the label within the floor box next to the device, do not install on the top of the coverplate, they will get worn off.
- 3.10 O&M MANUAL
- A. Provide O&M Manual as specified in specification section 260100. Include both a paper copy and digital pdf copy of the O&M Manual.

END OF SECTION

SECTION 260573
SHORT-CIRCUIT COORDINATION AND ARC FLASH HAZARD
ANALYSIS COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements of the "Study", which is a computer generated analysis of the designed, manufactured, and installed electrical distribution system. The analysis shall include short-circuit coordination and arc flash hazard analysis as described below.
- B. This Contractor shall include a complete study in the bid. The bid shall include all revisions necessary to achieve a complete study that is accurate per the construction documents and all accepted study recommendations – change orders to provide revised studies based on the bid documents will not be approved.
- C. This study shall include short-circuit and arc flash analysis for all panelboards, low-voltage distribution transformers, enclosed switches and circuit breakers, magnetic motor starters, VFD's. This shall include all new equipment in the new building.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Division 26 requirements for study requirements.

1.4 DATA COLLECTION FOR THE STUDY

- A. The Contractor shall provide the required data for preparation of the study. The Engineer performing the system study shall furnish the Contractor with a listing of the required data immediately after award of the contract to the Engineer performing the study.
- B. The Contractor shall expedite collection of the data to assure completion of the study as required for final approval of the electrical distribution equipment submittals and/or prior to release for manufacturing.

1.5 SUBMITTALS

- A. Qualifications: Submit qualifications for approval prior to commencement of the study for the Professional Engineer that will perform the study.

1. The study shall be prepared by a qualified Professional Engineer from the electrical distribution manufacturer or approved consultant that is currently involved in high-and low-voltage power system evaluations and has a minimum of five (5) years of experience in power systems coordination and analysis.
2. The Professional Engineer shall be registered in the State of Virginia and shall stamp, sign, and date each study submittal.
3. The firm or Professional Engineer performing the study shall demonstrate capability and experience to provide assistance during start up as required.

B. Required Study Submittals:

1. Design Submittal: This submittal shall include the electrical distribution system as designed on contract documents utilizing electrical distribution equipment from manufacturers being submitted.
 - a. Prior to this submittal the Engineer performing the study shall:
 - (1) Submit qualifications for review and approval.
 - (2) Provide the Contractor with a list of all required data needed to perform the study.
 - b. Prior to this submittal the contractor shall provide:
 - (1) The conductor submittal for review and approval.
 - (a) In particular, where the contractor opts to provide aluminum conductors as specified in 26 05 19, the contractor shall submit the aluminum substitution chart for all feeders being substituted.
 - (b) Approval of the aluminum substitution chart is required prior to the study Design Submittal.
 - (2) All required data needed by the Engineer performing the study. This includes coordinating with local utility company to determine the available fault current at the service entrance pad mounted transformer. Also obtain all transformer characteristics required by the Engineer performing the study.
 - c. This submittal shall be submitted to the Design Engineer along with the electrical distribution equipment submittals.
 - d. Approval of the electrical distribution equipment will be dependent on the approval of the study, which is typically approved during the CA Submittal. Prior to releasing the electrical distribution equipment for manufacturing both the study and the electrical distribution equipment submittals are required to be approved.
 - (1) If approval of the study may cause delay in equipment manufacturing thereby causing a delay in the project schedule, preliminary approval

from the Design Engineer of this Design Submittal may be obtained. Preliminary approval will depend on the conditions of the Design Submittal and whether or not sufficient study data was provided to ensure that the selection of device ratings and characteristics will be satisfactory.

- (2) A preliminary approval does not alleviate the requirements for submitting the CA and Final Submittals below.
2. CA Submittal: This submittal shall include all marked up revisions from the Design Submittal along with all revisions to the electrical distribution equipment associated with their first submittal mark ups, all changes per approved submittals from all other disciplines, and all changes to contract documents per addendum, requests for information, requests for proposal, and/or review/field comments from AHJ.
 - a. Prior to this submittal the contractor shall:
 - (1) Review all approved submittals from all disciplines for any changes to the electrical distribution equipment. Notify Design Engineer of any changes not already addressed in the approved submittals from the other disciplines.
 - (2) Review all addendums, requests for information, request for proposals, and review/field comments from AHJ for any changes to the electrical distribution equipment.
 - (3) Coordinate with the manufacturer(s) of the electrical distribution equipment to include all marked up comments in the review of the Design Submittal, the distribution equipment submittal, and all changes associated with approved submittals from all other disciplines. If required, resubmit the electrical distribution equipment with the CA Submittal for review and approval.
 - b. Prior to this submittal the Engineer performing the study shall:
 - (1) Coordinate with the contractor for any outstanding data that still needs to be collected. All data shall be finalized for this submittal.
 - c. This submittal shall be submitted to the Design Engineer along with any submittals showing changes to the electrical distribution equipment.
 - d. Where this submittal is approved, the electrical distribution equipment will be capable of being approved to be released for manufacturing if the equipment submittals are approved.
3. Final Submittal: This submittal shall include all final changes to the electrical distribution equipment associated with the As-Built conditions.

- a. Prior to this submittal the contractor shall:
 - (1) Review all addendums, requests for information, requests for proposals, and review/field comments from AHJ for any changes to the electrical distribution equipment.
 - (2) Provide the Engineer performing the study all As-Built changes to include into the study.

1.6 REFERENCES AND CODES

A. Short-Circuit Coordination:

- 1. 2020 NFPA 70: National Electrical Code (NEC):
 - a. Article 110.9 – Interrupting Rating
 - b. Article 110.10 – Circuit Impedance, Short Circuit Ratings, and Other Characteristics
 - c. Article 240.12 – Electrical System Coordination

B. Arc Flash Hazard Analysis:

- 1. 2021 NFPA 70E: Standard for Electrical Safety in the Workplace:
 - a. Article 100 – Definition of “Arc Flash Hazard Analysis”
 - b. Article 130.5 – Arc Flash Risk Analysis
- 2. 2020 NFPA 70: National Electrical Code (NEC):
 - a. Article 110.16 – Arc-Flash Hazard Warning
 - b. Article 110.21 (B) – Field-Applied Hazard Markings

PART 2 - PRODUCTS

2.1 SHORT-CIRCUIT COORDINATION AND ARC FLASH HAZARD ANALYSIS STUDY

- A. The study shall be performed by means of a computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.
- B. Short-Circuit Coordination: Provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, switchboard, distribution panelboard, pertinent branch circuit panelboard and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, 3-phase motor fault contribution

25hp and larger (coordinate with other Divisions for motor data), short circuit KVA and symmetrical and asymmetrical fault currents. Do not "lump" motors together.

- C. Arc Flash Hazard Analysis: Determine the flash protection boundary, the incident energy, the hazard/risk categories, and the Personal Protective Equipment (PPE) that persons within the flash protective boundary shall use. Provide recommended wording for arc-flash labels for all the electrical distribution equipment, and provide the labels.
- D. Include complete fault calculations as specified herein based on contract documents.
- E. Notify Design Engineer in writing of circuit protective devices not properly rated for fault conditions.
- F. Mechanical Contractor to provide settings for VFD's and/or motor starters that are furnished as part of the mechanical equipment.

2.2 STUDY REPORT

- A. The results of the study shall be summarized in a final report. Study shall be submitted electronically.
- B. The report shall include the following sections:
 - 1. Descriptions, purpose, bases and scope of the study.
 - 2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties and commentary regarding same.
 - 3. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
 - 4. A schedule showing the settings of all adjustable breaker functions based on the approved manufacturer's equipment to be furnished on this project.
 - 5. A schedule showing the arc flash protection boundary, the incident energy, the hazard/risk categories, and the personal protective equipment that personnel within the arc flash protective boundary shall use. Provide recommended working boundary for arc flash hazard warnings. Also provide sample arc-flash label.
 - 6. One-line riser diagram of the entire electrical distribution system or the portion(s) of the system included in the study. Provide the name of the equipment as is designated on the contract documents. Provide the size, type (AL or Cu), and quantity of the feeders next to each feeder. Provide the frame size (amps), Trip setting (amps), fault current rating, and calculated fault current next to each overcurrent protective device. Provide the KVA rating and calculated fault current next to each transformer. Provide the KW rating, power factor, and calculated fault current for generator. Provide the amp rating, fault current, current and calculated fault current next to each automatic transfer switch. Include the voltage and phase next to each piece of equipment. Provide horsepower rating of each 3-phase motor.

PART 3 - EXECUTION

3.1 POWER COMPANY OR LOCAL CODE ENFORCEMENT AUTHORITY APPROVAL

- A. Where required, copies of the final report shall be submitted to the power company and/or local code enforcement authority for their review and approval. Approved copies of the report shall be submitted to the Design Engineer.

3.2 FIELD SETTINGS

- A. A factory-authorized representative shall perform field adjustment of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the schedule of all adjustable breakers provided in the approved study. Contractor shall notify Design Engineer once all breakers have been adjusted for field verification approval. Once all breaker settings have been field verified and approved by the Design Engineer the contractor shall provide and install all necessary locking devices over the covers to the adjustable setting on the breakers. All settings shall be required to be locked so that they cannot be tampered with by unqualified personnel.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved study shall be carried out by the Contractor at no additional cost to the Owner.

3.3 ARC FLASH LABELS

- A. Provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
 - 1. UL969 – Standard for Marking and Labeling Systems
 - 2. ANSI Z535.4 – Product Safety Signs and Labels
 - 3. NFPA 70 (National Electrical Code) – Article 110.16
- C. The label shall include the following information:
 - 1. System Voltage
 - 2. Flash protection boundary
 - 3. Arc Flash Incident energy value (cal/cm²)
 - 4. Limited and restricted Approach Boundaries
 - 5. Study issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.
- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

1. Floor Standing Equipment: Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the study.
2. Wall Mounted Equipment: Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Labels shall be field installed. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course which includes NFPA 70E material including the selection of personal protective equipment.

3.4 ARC FLASH TRAINING

- A. The vendor providing the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The trainer shall be an authorized OSHA Outreach instructor.

3.5 O&M MANUAL

- A. Provide O&M Manual as specified in specification section 260100. Include both a paper copy of the study report along with a digital pdf copy of the study report and a digital copy of the project software file. Coordinate with the owner for type of software file required: ETAP, SKM, etc.

3.6 COMMISSIONING

- A. Prior to energizing the panelboards, transfer switch(es), generator, combination motor starters, VFDs and enclosed circuit breakers, commissioning agent will verify that all breaker settings in the breaker settings table of the final approved Coordination Study have been properly adjusted to the values in the breaker settings table, set by a factor-authorized representative. The commissioning agent shall also verify that these settings are locked so that they cannot be tampered with by unqualified personnel.

END OF SECTION

SECTION 260583
WIRING CONNECTIONS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the basic requirements of electrical connections for equipment specified in Division 8, 10, 11, 12, 13, 14, 21, 22 and 23 sections and Division 26, 27 and 28 sections making reference to electrical connections for equipment specified herein.
- B. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Refer to other Division 26 sections for motor starters, controllers and disconnects not furnished as integral part of equipment.
- B. Refer to sections of other Divisions for motor starters, controllers, VFD's and disconnects furnished integrally with equipment and for specific individual equipment power requirements.
- C. Refer to other Division 26 sections for junction boxes, raceways and conductors/cables required for connecting motors and other electrical units of equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Refer to other Division 26 sections for manufacturers of electrical connection products.

2.2 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, junction boxes, raceways, conductors/cables, disconnect switches, starters, controllers, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices, terminations, and connections.

- B. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals as recommended by equipment manufacturer for intended applications.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Connect electrical power supply conductors to equipment conductors or terminals in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- B. Cover splices with electrical insulating material equivalent to or greater than electrical insulation rating of those conductors being spliced.
- C. Prepare cables and conductors by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" conductors while stripping wire.
- D. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- E. Tighten connectors and terminals, including screws and bolts, in accordance with the equipment manufacturer's published torque tightening values for equipment connectors.
- F. Fasten identification markers to each electrical power supply conductor/cable conductor which indicates their voltage, phase and feeder number in accordance with Division 26. Affix markers on each terminal conductor, as close as possible to the point of connection.

3.3 CONNECTIONS TO EQUIPMENT

- A. Final electrical connections to equipment furnished under other sections of these specifications or specified to be furnished by the Owner shall be provided as required for the individual item of equipment. Provide the conduit, outlet boxes, and power wiring from the power source to the motor or equipment junction box, wiring devices, transformers, relays, starters, VFD's, disconnect switches or circuit breakers, including wiring through starters, VFD's or safety switches, in accordance with the manufacturer's installation instructions. The presumed location of all presently

envisioned equipment having electrical connections is shown or scheduled, but these locations are for estimating purposes only and the contractor shall prepare the bid to allow for any possible rearrangement of the equipment listed or as shown or scheduled. Prior to roughing in conduit, receptacles, or other outlets or equipment, verify the locations and characteristics of equipment and verify heights and locations of required connections from an approved shop drawing or roughing-in drawing. Use roughing-in dimensions of electrically operated units furnished by the supplier.

B. Provide connections for, but not limited to, the following equipment as specified:

1. Kitchen Equipment: Provide the required NEMA rated outlet for kitchen equipment provided or specified with cord-and-plug connection. Provide direct connections by extending conduit and wiring to kitchen equipment requiring direct electrical connections and make all final connections. All electrical connections to the kitchen equipment shall be furnished and installed as required by the kitchen equipment manufacturer. Outlets and connections to equipment shall be made from walls, except where special floor or ceiling outlets are indicated. Provide a flush junction box in wall beneath the operating level of the equipment for outlets and direct connections, and coordinate final mounting heights with equipment installer. All direct connections to equipment shall be with flexible liquid tight conduit. Plugs and cords on the equipment shall be completely wired, shortened, or lengthened as required to suit the outlets furnished. Provide ground-fault circuit interrupter protection for all 125 volt, single-phase, 15 and 20 amp receptacles. Provide a separate ground conductor for equipment.
2. Elevator Connections: Make final connections to the elevator control panel and provide the required outlets for the elevator accessories as required by the elevator manufacturer. Work for the elevator installation shall be in accordance with applicable requirements of the ANSI Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks, A17.1, including supplements, published by the American Society of Mechanical Engineers.
3. Architectural Motorized Doors: Install electrical wiring for motorized doors. Door controls shall be furnished by door manufacturer. Wiring and accessories shall be provided as required and the doors completely wired in accordance with the manufacturer's instructions.
4. Mechanical and Plumbing Equipment: See Divisions 21, 22 and 23 for any type or item of equipment requiring electrical connections. Provide all power wiring and control wiring of 110 volts and greater for controlling all equipment as described therein even though control wiring may not be shown on Electrical Drawings. See Mechanical Drawings for exact locations of equipment and Mechanical Specifications for control of equipment.
5. Outdoor Signs: Provide electrical circuits, junction boxes and controls for the exterior signs on the building or located on the site as indicated. Junction boxes shall be located as directed by the sign supplier. Provide low-voltage control wiring conduit(s) to the signs, to be terminated as directed on the job by the sign supplier. Comply with all requirements of NEC Article 600.

3.4 FIELD QUALITY CONTROL

- A. Final connections and proper operation of equipment connected under this contract shall be supervised by the equipment supplier. This Contractor shall certify in writing to the Architect that the connected equipment is properly connected and the equipment is operating properly in accordance with these contract specifications, the equipment manufacturer's wiring diagrams, and instructions of the equipment supplier or manufacturer.

END OF SECTION

SECTION 260800
ELECTRICAL SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.1 INTENT

- A. The intended result of the Electrical Commissioning process is to assure the Owner that the electrical systems are installed, operate, and perform in accordance with contract drawings and specifications prior to Owner PM's acceptance of the building and that OWNER personnel are properly trained to operate and maintain the systems.

1.2 SCOPE

- A. Work Included: This project will have automatic lighting control systems commissioned. That portion of the commissioning effort that the Installing Contractor is responsible to execute is defined herein. The commissioning process will be directed by a Commissioning Agent. The electrical commissioning shall provide substantial verification that systems and equipment are installed and performing in accordance with the contract documents and design intent. This independent commissioning shall be complementary to the construction period services performed by the Architect and Electrical Consulting Engineer.
- B. Work Not Included: It shall not be incumbent upon the Commissioning Agent to verify adequacy of electrical systems to accommodate the heating, cooling, or ventilating loads imposed upon them, i.e. to evaluate design. Systems installed and performing in accordance with plans and specifications that do not achieve and/or maintain conditions in accordance with design intent will be so noted when observed.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.
- B. This section complements and forms an integral part of Division 26 and all other sections of Division 26 shall have the same force and effect as if printed herewith in full.
- C. The specification Section Basic Requirements for Electrical Systems forms a part of this section and shall have the same force and effect as if printed herewith in full.

1.4 RELATED WORK

- A. Installing Contractor: The contractor responsible for the installation of the equipment and/or systems to be commissioned (Installing Contractor) shall be responsible for all pre-commissioning work as defined within this specification section, in addition to all associated work in the individual commissioned equipment and/or systems related Division 26 and Division 23 specification sections.
- B. Electrical Contractor: All Division 26 Electrical specification sections form a part of this section and shall have the same force and effect as if printed herewith in full.
- C. Mechanical Contractor: All Division 23 Mechanical specification sections form a part of this section and shall have the same force and effect as if printed herewith in full.

1.5 SUPPLEMENTAL CONDITIONS

- A. All work of Division 26 and related Division 23 work must be complete prior to functional performance verification, unless approved in writing by the Owner's Project Manager. Exceptions to this are control system training that may be performed after occupancy. This includes completion and acceptance of the following tasks for all systems, including but not limited to:
 - 1. Submission of all data requested by the Commissioning Agent
 - 2. Correction of all identified deficiencies or written approval by the Owner PM for exception from this milestone
 - 3. Completed and signed start-up and pre-functional checklist documentation
 - 4. Required training of Owner personnel completed and approved
 - 5. Submission of the approved O&M manuals
- B. Remedial Work: Completion of remedial work required as a result of failed functional performance verification shall be the responsibility of the Installing Contractor. The time period for completion of remedial work required as a result of failed functional performance verification shall be fourteen (14) calendar days prior to the date of Owner PM's acceptance of Substantial Completion.
- C. The responsible Installing Contractor shall reimburse Owner for all costs associated with effort lost due to delays in Substantial Completion of the project. These costs shall include direct personnel expenses, plus overhead and profit, and travel costs for Owner's commissioning team members.

1.6 COMMISSIONING AGENT AUTHORITY

- A. Throughout the commissioning process, the commissioning agent's role is primarily one of an observer/witness; monitoring the installation, start-up, operation, and performance of the electrical and lighting systems. The commissioning agent shall have no authority to alter design or installation procedures. If acceptable performance cannot be achieved, it will be the commissioning agent's responsibility to apprise the Owner PM, design engineer, and/or contractor of the deficiency. Corrective actions shall be the responsibility of the Owner PM, design engineer, and/or contractor; and

not that of the commissioning agent. The commissioning agent shall have the authority to require tests and demonstrations to verify proper performance.

1.7 ARCHITECT/ENGINEER RESPONSIBILITY

- A. In addition to their normal performance of Construction Period Services, the Architect/Engineer will furnish to the Commissioning Agent one copy of all approved electrical systems Shop Drawings and Submittals and place the Commissioning Agent on the mailing list for all communications regarding the commissioned electrical systems.
- B. The Architect/Engineer shall respond in writing to issues cited in correspondence provided by the Commissioning Agent.

1.8 CONTRACTOR'S RESPONSIBILITY

- A. The General Contractor shall be responsible for assuring that the commissioning agent is provided with all relevant correspondence, submittals, notifications, and assistance as may be required to satisfactorily complete the commissioning process using whatever personnel, time and resources that are required. This Section provides minimum commissioning requirements; however, the Contractor shall exceed those requirements whenever necessary to achieve the intent of Electrical Commissioning.
- B. The General Contractor shall include in his Bid the cost of furnishing the material requested and manpower necessary for the verification of proper electrical system installation and operation as specified in this Section.
- C. The Contractor shall respond in writing to issues cited in correspondence provided by the Commissioning Agent.

1.9 CONTRACTORS' SUBMITTALS AND DOCUMENTATION

- A. Commissioning Team: The General Contractor shall provide the Commissioning Agent with a list of team members (including: member's name, contract affiliation, title, responsibility, phone, fax, email, and mailing address) who will represent the Installing Contractors in pre-functional checks and functional performance verification. Submit no later than at the Pre-Commissioning Meeting.
- B. Schedule and Notification:
 - 1. The Construction Schedule shall incorporate and provide for commissioning milestones and activities. General Contractor shall coordinate with the Electrical Subcontractor to provide adequate time to accommodate the witnessing of milestone events, equipment start-ups, and all other activities requiring scheduled participation of the Commissioning Agent as defined in the pre-functional checks and functional performance verification forms.
 - 2. Notification of an impending event shall be provided to the Commissioning Agent at least 48 hours in advance, notification may be via fax or email. The 48 hour notice is acceptable if the event is accurately scheduled on the most current

Construction Schedule. Events not accurately identified in the Construction Schedule shall require one week notice.

C. Submittals:

1. Operating and Maintenance Manuals shall be provided to the Architect/Engineer for review no later than sixty (60) days after the last submittal/shop drawing has been approved. A/E shall provide the Operating and Maintenance Manuals to the Commissioning Agent after the A/E's review. The Manuals with A/E and Commissioning Agent's review comments will be returned to the Contractor for preparation for use in training of Owner's operating and maintenance personnel. Return of the reviewed Manuals shall be approximately six weeks after Contractor submission.
2. Demonstration and Training schedule shall be submitted to the Commissioning Agent at the time of submission of the Operation and Maintenance Manuals. Schedule shall fully detail all demonstrations and training that are to be provided by the Contractor to the Owner's operating and maintenance personnel. Actual dates and times, if used, shall be understood as tentative and subject to change based upon actual construction progress. However, at a minimum, the Demonstration and Training schedule shall include time allocations (i.e. hours) for each piece of equipment or system for which demonstration and training are specified. Commissioning agent review comments will be provided to when Operating and Maintenance Manuals are returned to the Contractor.

D. Documentation:

1. The electrical sub-contractor shall maintain on site the pre-functional checklists, organized by system and by subsystem. Entries shall be made on the checklists no less than weekly and/or as items are completed.
2. Two weeks prior to scheduled start of functional performance verification, the General Contractor shall provide the Commissioning Agent with a comprehensive report asserting that systems are ready for functional performance verification. The report shall include the following materials:
 - a. Detailed descriptions of any deviations from the contract documents (including but not limited to: change orders, addenda, and variations) organized by system and by subsystem.
 - b. Complete set of as-built drawings and documents, clearly identifying all deviations from the contract documents and organized by system and by subsystem.
 - c. Complete set of all required manufacturer's equipment tests, organized by system and by subsystem.
 - d. Completed pre-functional checklists, organized by system and by subsystem.
 - e. Results of any failed tests and detailed description of corrective actions taken, organized by system and by subsystem.

E. Additional Information:

1. The Installing Contractor may receive a written request from the Commissioning Agent requesting specific information needed about each piece of commissioned equipment or system.
2. Typically this request for specific information will include: detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures; full details of any Owner contracted tests; fan and pump curves; full factory testing reports, if any; and full warranty information, including all responsibilities of the Owner PM to keep the warranty in force clearly identified. In addition, copies of the installation and checkout materials shipped with the equipment and the actual field checkout sheet forms used by the factory or field technicians shall be submitted to the Commissioning Agent.
3. The Commissioning Agent may request further documentation deemed necessary for the commissioning process. These data requests may be made prior to the normal submittal process.

- F. Contractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the Commissioning Agent's review.

1.10 SEQUENCING AND SCHEDULING

- A. The electrical systems commissioning may be construed to be in three parts: installation verification, training and demonstrations, and performance verification.
- B. Installation verification utilizes Pre-Functional Check Lists, documenting that equipment/systems is/are installed and started in accordance with contract documents and is/are serviceable.
- C. Contractor's training of and demonstrations for Owner's operating and maintenance personnel occurs after Pre-Functional Checks are complete and all test and inspection reports and operation and maintenance manuals have been submitted and approved. Training and demonstrations usually precede Performance Verification; some training, such as use and operations of the automation system, occurs during and after performance verifications.
- D. Performance verification employs Functional Performance Verification forms and occurs only after all work required in related Sections, has been successfully completed.

PART 2 - PRODUCTS

NOT APPLICABLE TO THIS SPECIFICATION

PART 3 - EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

- A. The General contractor shall designate team members to participate in the pre-functional checks and functional performance verification specified herein. In addition, the project manager, the architect/engineer and the manufacturer will represent Owner. The team members shall be designated as follows:
- Designation Function
 - CX Commissioning Agent
 - GC General Contractor
 - MC Mechanical Contractor
 - ATC Controls Contractor
 - TAB Testing and Balancing Contractor
 - OR Owner's Representative (Owner PM)
 - A/E Architect/Engineer
 - EC Electrical Contractor
 - MFR Manufacturer
- B. The Pre-Functional Checklists and Performance Verifications assign responsibility for specific commissioning activity tasks. An un-shaded box indicates where participation by a specific commissioning team member is required. The responsible Installing Contractor(s) and any additional commissioning team members identified on the checklist shall initial and date the appropriate forms for each task indicated in these Checklists. One form shall be completed for each piece of commissioned equipment or system. By initialing and dating the entry, the responsible Installing Contractor(s) and identified additional commissioning team members shall indicate completion and verification of proper installation in accordance with contract requirements and acceptance of responsibility for the installation of the equipment and/or systems.
1. Forms are to be initialed and dated at the time of completion of the specific checklist task item.
 2. Where additional forms are required, the responsible Installing Contractor shall be responsible for photocopying or replicating the appropriate form(s).

3.2 RESPONSIBILITIES

- A. Each member of the commissioning team has responsibilities to the successful completion of the commissioning process as follows:
- B. The OWNER PM shall perform their normal construction contract administration functions.
- C. The Architect shall provide adequate support to the Consulting Electrical Engineer as related to his duties in the commissioning process. It shall also be the Architect's responsibility, either directly or through his assignee, to assure that the commissioning agent is:

1. Provided copies of approved shop drawings as they are returned to the Contractor
 2. Notified of time, date, and place of all regularly scheduled progress meetings, and of any special meetings that may be called regarding electrical systems.
 3. Copied on all correspondence pertinent to the electrical systems including but not limited to minutes of progress meetings, responses to contractor requests for information, change order documentation.
- D. The Consulting Electrical Engineer shall perform his normal construction contract administration functions.
- E. The General Contractor shall, in addition to his normal responsibilities for construction of the project, assure that his subcontractors recognize the authority of the commissioning agent and perform responsive to the requirements of the commissioning process. He shall assure that proper notification, at least 48 hours in advance, is provided to the commissioning agent of the milestones of the electrical systems installation, at a minimum as follows:
1. Start-up of equipment specified to be performed by factory authorized personnel.
 2. Date of punch-out inspections
 3. Date of training and instructions to Owner's operating personnel regarding operations of the electrical system
- F. The Electrical Subcontractor shall perform his normal contract obligations and be responsive to the authority of the commissioning agent.
- G. The Electrical Subcontractor shall, in addition to his normal responsibilities for construction of the project, assure that proper notification of the milestones of the electrical systems installation as cited in Paragraph D. are provided to the General Contractor. The Electrical Subcontractor shall assure that his subcontractors recognize the authority of the commissioning agent and perform responsive to the requirements of the commissioning process.
- H. The Commissioning Agent will follow the procedures as set forth in the paragraph titled Commissioning Agent Procedures to execute his responsibility for:
1. Verifying that the required electrical systems are installed and operating in accordance with contract documents and specifications.
 2. Assuring that Owner's Operating and Maintenance personnel are fully trained on systems operation and maintenance.
 3. Assuring that Close Out documentation is properly provided to the Owner's PM.

3.3 TESTS

- A. The pre-functional checks and functional performance verification shall be performed in a manner that essentially duplicates the checking, testing, and inspection methods established in the related Sections. Where checking, testing and inspection methods are not specified in other Sections, methods shall be established that will provide the information required. Testing and verification required by this Section shall be

performed throughout the commissioning process. Requirements of this Section do not supplant those in related Sections but may expand upon them. The Contractor shall provide all materials, services, and labor required performing the pre-functional checks and functional performance verification. A pre-functional check or functional performance verification shall be aborted if any system deficiency prevents the successful completion of the test or if any non-Owner commissioning team member is not present for the test. The Contractor shall reimburse the Owner for all costs associated with effort lost due to tests that are aborted. These costs shall include direct personnel expenses, plus overhead and profit, and travel costs for Owner commissioning team members.

- B. Pre-Functional Checks: Pre-functional checks shall be performed for the items indicated. Deficiencies discovered during these checks shall be corrected and re-tested in accordance with the applicable contract requirements.
- C. Functional Performance Verification: Functional performance verification shall be performed for the items indicated. Functional performance verification shall begin only after all pre-functional checks have been successfully completed. Verifications shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Verifications shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance verification checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. The checklist shall then be repeated until it has been completed with no errors.

3.4 COMMISSIONING AGENT PROCEDURES

- A. The Commissioning Agent will perform systems commissioning following the procedures listed herein, and all members of the Commissioning Team shall cooperate fully with the execution of these procedures. To achieve electrical systems commissioning, the Commissioning Agent shall:
 - 1. Attend periodic construction progress meetings and perform unscheduled walks through the building to observe and keep abreast of electrical systems installation progress, means, and methods. Commissioning agent's presence at meetings and in the building will be for his benefit in preparing to commission the building and shall in no way be construed as superseding the authority of the project architect/engineers.
 - 2. Review electrical Shop Drawings and Submittals after approval of the Project Consulting Electrical Engineer. The purpose of this review is primarily one of familiarization with equipment to be furnished on the project for on site verification by the commissioning agent and in no way relieves the Consulting Electrical Engineer of his duties or supersedes his authority for shop drawing review.
- B. Issue Pre-Functional Check Lists relevant to the project for Contractor monitoring and verification of installation progress. Establish milestones in the electrical system installation at which time interim commissioning status reports will be prepared and issued by the Commissioning Agent.

- C. Be present to observe the start-up of equipment that is supervised and certified by the equipment manufacturer's authorized agent.
- D. Examine and document all light fixtures and drivers installed are per the approved shop drawings. Observe and documents the operation of all lighting fixtures and lighting controls in each room are operating and are programmed per the sequence of operations. Examine and document all electrical equipment is provided with the Arc Flash Hazard labels per 260573 specification and the approved Arc Flash Hazard Study. Examine and document all electrical equipment is provided with the equipment labels per 260553 specification and per the approved shop drawings for all electrical equipment (Note all electrical equipment will have an Identification Schedule in the submittal review comments).
- E. Review Contractor prepared Operating and Maintenance Manuals and be present during Electrical Contractor instructions to the Owner's operating personnel regarding operations and maintenance of the electrical system.
- F. Review Contractor prepared As-Built drawings and all certifications and warranties required for submission by project specifications.
- G. Furnish a written report and recommend acceptance of the electrical system upon satisfactorily completing the commissioning process. Recommendations for approval, when appropriate, will be forwarded to the project Architect/Engineer for inclusion in their final submission of project close out documentation to the Owner PM.

3.5 CONTRACTOR COMMISSIONING PROCEDURES

- A. The General Contractor and all relevant Sub-Contractors shall, in addition to being responsive to the procedures cited for execution by the Commissioning Agent in paragraph titled Commissioning Agent Procedures, perform as follows to achieve satisfactory electrical systems commissioning. The Contractor shall:
 - 1. Demonstrate the performance of each piece of equipment to the Commissioning Agent and the Owner PM after completion of construction. Schedule the sub-Trade Representatives as may apply to demonstrate the performance of the equipment and systems.
- B. Evaluations:
 - 1. Owner's Commissioning Agent shall observe the calibrations and measurements associated with the functional performance verification of the equipment, systems and control systems identified herein; set the time schedule of functional performance verification; and make any necessary corrective or remedial work recommendations to ensure that the commissioned equipment and systems function as described in the control sequence of operation and perform in accordance with design intent.

2. The Installing Contractor shall operate all equipment and systems in support of the commissioning work effort and shall provide all labor, equipment, and materials necessary to allow operational and performance verification of all commissioned equipment and systems.
- C. Weather-Dependent Verification Procedures: Weather-dependent performance verification that cannot be adequately achieved by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results may also require re-verification in the appropriate season.
- D. At a minimum, the performance and operation demonstrations of the following equipment and/or systems will be required:
1. Lighting Fixtures and Drivers: Verify all light fixture and drivers are installed per approved submittals.
 2. Lighting Controls: Verifying lighting controls in each room are programmed per the sequence of operations.
 3. Arc Flash Hazard: Verify all Arc Flash Hazard labels installed on electrical gear per the approved Coordination Study.
 4. Identification: Verify all new and existing electrical equipment is provided with the specified nameplates and that all as-built panel schedule index cards (typed not handwritten) are provided in each new panelboard and any existing panelboard that is modified. Verify all circuit breakers are numbered. (Note all electrical equipment will have a Identification Schedule in the submittal review comments).
- E. Sampling techniques may be employed for performance verification of multiple identical pieces of equipment/systems. Field verification shall be performed for 20% of each type of identical pieces of equipment/systems. Commissioning Agent's selection of sample equipment/systems to be field verified shall be guided by performances demonstrated in TAB report and trends. Note that sampling technique does not apply to pre-functional verification.
- F. Should any performance verification reveal operation or performance not in accordance contract documents, the Contractor shall rectify the deficiency, and re-inspection shall be performed. Should operation or performance still not be as specified on the re-inspection due to Contractor's work, the time and expenses of the Commissioning Agent to make further re-inspections shall be considered as additional cost to Owner. The total sum of such costs shall be deducted from the final payment to the Contractor.

3.6 ISSUES RESOLUTION

- A. During the commissioning process, the Commissioning Agent may identify issues that require corrective action. The Commissioning Agent has no authority to dictate ways and means of issues resolution other than enforcing the dictates of Contract Drawings and Specifications. Resolution of issues that require interpretations or modifications to the contract documents shall be the responsibility of the Architect and Engineers.

Project completion date shall not be delayed due to lack of timely issues resolution unless authorized contract extensions have been executed.

- B. Written responses shall be made to issues reported by the Commissioning Agent. The Commissioning Agent shall provide status reports and issues logs as deemed appropriate during the commissioning process with original provided to Owner's PM and copies to the General Contractor, and Architect. The General Contractor and/or Architect shall provide the Owner's PM with a written response to each issue cited by the Commissioning Agent as to corrective actions implemented. The written response shall be provided to the Owner's PM within two (2) weeks of the date of the Commissioning Agent's issues citing correspondence; copies shall be provided to the Commissioning Agent, General Contractor, and Architect. Issues that have not been fully resolved within the two week period shall be noted as such with explanation of intended resolution; and subsequent status reports of the continued issue resolution shall be made in writing at two week intervals until such time as the issue has been fully rectified. The Owner's PM reserves the right to withhold partial payment for construction contract or professional services until satisfactory resolution of electrical issues have been documented and verified.

3.7 SATISFACTORY COMPLETION

- A. The Contractor's personnel shall be made available to execute all aspects of the commissioning process until the Owner's PM accepts final results. Commissioning tasks and meetings may be repeated until the Owner's PM is satisfied and will not be fixed as one-time, one-chance events for the Contractor.

3.8 PHASING OF CONSTRUCTION AND COMMISSIONING

- A. Where project completion is performed in stages, the commissioning plan will take into account the staged start-up of each phase as shown on the Drawings and/or Specified.

3.9 CLOSE OUT SUBMITTALS

- A. Close out documents, consisting of but not limited to As-Built Drawings, Certificates of Inspections, Warranties, Operating and Maintenance Manuals, transmittals documenting delivery of spare parts as submitted to the Architect/Engineer shall be copied to the commissioning agent for concurrent review.
- B. Operating and Maintenance Manuals shall be submitted for review and approval well before any equipment/systems demonstrations or training occurs. The approved O&M Manuals shall be employed during demonstrations and training.

3.10 DEMONSTRATIONS AND TRAINING

- A. Demonstrations and training shall be responsive to the requirements of Division 26 specification sections and Division 1 sections. General Contractor shall provide schedule for demonstration and training of Owner's operating and maintenance personnel. Preliminary schedule shall be prepared and submitted along with O&M Manuals review submittal and shall be honed after O&M Manuals have been approved.

Final demonstration and training schedule shall provide specific dates, times, and subject matter and shall be re-submitted at least four (4) weeks prior to any demonstrations/training occurring to allow for review, approval, notification, and coordination.

3.11 COMMISSIONING REPORTS

- A. The Commissioning Agent shall document commissioning milestones with reports. The documents shall acknowledge acceptance at the milestone or separately list issues observed or discovered requiring rectification. The document shall be distributed to Commissioning Team members.
- B. The Commissioning Agent shall prepare a final formal report to the Owner's PM that will include a narrative in the form of an Executive Summary of the results of commissioning process, impressions of the demonstration and training sessions, and a certification that the verification of each item is complete and all systems are operating as intended.

END OF SECTION

SECTION 260913
ELECTRICAL POWER MONITORING AND CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection for a complete operational Power Monitoring and Control System. It shall include, but not be limited to, devices for monitoring, control and protection, ancillary equipment, and startup and training services.
- B. The power monitoring and control system shall be installed on the electrical equipment such as the motor control centers and switchboards including the essential electrical systems as shown on the drawings or otherwise indicated herein.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage cable.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.
- D. Section 26 18 41, MEDIUM-VOLTAGE SWITCHES: High voltage switches.
- E. Section 26 24 11, DISTRIBUTION SWITCHBOARDS: Secondary distribution switchboards.
- F. Section 26 24 19, MOTOR-CONTROL CENTERS: Motor control assemblies.
- G. Section 26 27 13, ELECTRICITY METERING: Electrical metering equipment.

1.3 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
 - 1. Product Data: For each type of product indicated.
 - 2. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.

- B. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components.
 - 2. Installations of devices, wirings, connections, programming, testing, troubleshooting, etc. shall be performed by factory certified technicians.
- C. Other Informational Submittals: System installation and setup guides, with data forms to plan and record options and setup decisions.
- D. Qualifications: The manufacturer of the equipment shall have been regularly engaged in the manufacture of the specified remote devices for a period of at least five (5) years and demonstrate that these products have been utilized in satisfactory use in functioning systems for similar applications. The manufacturer shall have at least five (5) years demonstrated capability in PMS design, installation and start-up.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata), form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
 - 802.3-02 CSMA/CD Access Method and Physical Layer Specification
 - 37.90-89 Standard for Relays and Relay Systems Associated with Electric Power Apparatus
- C. FCC Emission Standards (FCC):
 - 15, Part J Radio Frequency Devices
- D. National Fire Protection Association (NFPA):
 - 70-11 National Electrical Code (NEC)

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 Warranty

- A. The manufacturer shall warrant the equipment supplied hereunder. The warranty shall include:

1. One (1) year free telephone technical support
2. Warranty on all hardware supplied under this system shall be for one (1) year from start-up or 18 months from shipment, whichever is less.
3. When the Manufacturer provides start-up service on the hardware supplied under this system, the standard warranty shall be for two (2) years from start-up or 30 months from shipment, whichever is less.
4. During the guarantee period, emergency service and routine maintenance calls shall be responded to within a 4-hour period during the hours of 7am-7pm. Between the hours of 7pm-7am, calls shall be responded within an 8-hour period.

PART 2 - PRODUCTS

2.1 SURGE PROTECTION

- A. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.
- B. Transient Voltage Surge Suppression and Electromagnetic-Interference Immunity: Include in solid-state equipment. Comply with IEEE C37.90.
- C. Signal wiring shall be integrated to the main Ethernet line.

2.2 POWER MONITORS

- A. Separately mounted, permanently installed instrument for power monitoring and control:
 1. Enclosure: NEMA 250, Type 1.
- B. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Indoor installation in non-air-conditioned and nontemperature-controlled spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
- C. RMS Real-Time Measurements:
 1. Current: Each phase, neutral, average of three phases, percent unbalance.
 2. Voltage: Line-to-line each phase, line-to-line average of three phases, line-to-neutral each phase, line-to-neutral average of three phases, line-to-neutral percent unbalance.
 3. Power: Per phase and three-phase total.
 4. Reactive Power: Per phase and three-phase total.

5. Power Factor: Per phase and three-phase total.
6. Frequency.
7. THD: Current and voltage.
8. Accumulated Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
9. Incremental Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
10. Conditional Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).

D. Demand Current Calculations, per Phase, Three-Phase Average and Neutral:

1. Present.
2. Running average.
3. Last completed interval.
4. Peak.

E. Demand Real Power Calculations, Three-Phase Total:

1. Present.
2. Running average.
3. Last completed interval.
4. Predicted.
5. Peak.
6. Coincident with peak kVA demand.
7. Coincident with kVAR demand.

F. Demand Reactive Power Calculations, Three-Phase Total:

1. Present.
2. Running average.
3. Last completed interval.
4. Predicted.
5. Peak.
6. Coincident with peak kVA demand.
7. Coincident with kVAR demand.

G. Average Power Factor Calculations, Demand Coincident, Three-Phase Total:

1. Last completed interval.
2. Coincident with kW peak.
3. Coincident with kVAR peak.
4. Coincident with kVA peak.

H. Sampling:

1. Current and voltage shall be digitally sampled at a rate high enough to provide accuracy to 63rd harmonic of 60-Hz fundamental.

2. Power monitor shall provide continuous sampling at a rate of 128 samples per cycle on all voltage and current channels in the meter.
- I. Minimum and Maximum Values: Record monthly minimum and maximum values, including date and time of record. For three-phase measurements, identify phase of recorded value. Record the following parameters:
 1. Line-to-line voltage.
 2. Line-to-neutral voltage.
 3. Current per phase.
 4. Line-to-line voltage unbalance.
 5. Line-to-neutral voltage unbalance.
 6. Power factor.
 7. Displacement power factor.
 8. Total power.
 9. Total reactive power.
 10. THD voltage L-L.
 11. THD voltage L-N.
 12. THD current.
 13. Frequency.
 - J. Current and Voltage Ratings:
 1. Designed for use with current inputs from standard instrument current transformers with 5-A secondary and shall have a metering range of 0-10 A.
 2. Withstand ratings shall be not less than 15 A, continuous; 50 A, lasting over 10 seconds, no more frequently than once per hour; 500 A, lasting 1 second, no more frequently than once per hour.
 3. Designed for use with voltage inputs from standard instrument potential transformers with a 120-V secondary.
 - K. Accuracy:
 1. Comply with ANSI C12.20, Class 0.5; and IEC 60687, Class 0.5 for revenue meters.
 2. Accuracy from Light to Full Rating:
 - a. Power: Accurate to 0.25 percent of reading, plus 0.025 percent of full scale.
 - b. Voltage and Current: Accurate to 0.075 percent of reading, plus 0.025 percent of full scale.
 - c. Power Factor: Plus or minus 0.002, from 0.5 leading to 0.5 lagging.
 - d. Frequency: Plus or minus 0.01 Hz at 45 to 67 Hz.
 - L. Input: One digital input signal(s).
 1. Normal mode for on/off signal.
 2. Demand interval synchronization pulse, accepting a demand synchronization pulse from a utility demand meter.
 3. Conditional energy signal to control conditional energy accumulation.

M. Outputs:

1. Operated either by user command sent via communication link, or set to operate in response to user-defined alarm or event.
2. Closed in either a momentary or latched mode as defined by user.
3. Each output relay used in a momentary contact mode shall have an independent timer that can be set by user.
4. One digital KY pulse to a user-definable increment of energy measurement. Output ratings shall be up to 120-V ac, 300-V dc, 50 mA, and provide 3500-V rms isolation.
5. One relay output module(s), providing a load voltage range from 20- to 240-V ac or from 20- to 30-V dc, supporting a load current of 2 A.
6. Output Relay Control:
 - a. Relay outputs shall operate either by user command sent via communication link or in response to user-defined alarm or event.
 - b. Normally open and normally closed contacts, field configured to operate as follows:
 - 1) Normal contact closure where contacts change state for as long as signal exists.
 - 2) Latched mode when contacts change state on receipts of a pickup signal; changed state is held until a dropout signal is received.
 - 3) Timed mode when contacts change state on receipt of a pickup signal; changed state is held for a preprogrammed duration.
 - 4) End of power demand interval when relay operates as synchronization pulse for other devices.
 - 5) Energy Pulse Output: Relay pulses quantities used for absolute kWh, absolute kVARh, kVAh, kWh In, kVARh In, kWh Out, and kVARh Out.
 - 6) Output controlled by multiple alarms using Boolean-type logic.

N. Onboard Data Logging:

1. Store logged data, alarms, and events in 80 KB of onboard nonvolatile memory.
2. Stored Data:
 - a. Billing Log: User configurable; data shall be recorded every 15 minutes, identified by month, day, and 15-minute interval. Accumulate 24 months of monthly data, 32 days of daily data, and between 2 to 52 days of 15-minute interval data, depending on number of quantities selected.
 - b. Custom Data Logs: One user-defined log(s) holding up to 96 parameters. Date and time stamp each entry to the second and include the following user definitions:
 - 1) Schedule interval.
 - 2) Event definition.
 - 3) Configured as "fill-and-hold" or "circular, first-in first-out."

- c. Alarm Log: Include time, date, event information, and coincident information for each defined alarm or event.
- 3. Default values for all logs shall be initially set at factory, with logging to begin on device power up.
- O. Alarms:
 - 1. User Options:
 - a. Define pickup, dropout, and delay.
 - b. Assign one of four severity levels to make it easier for user to respond to the most important events first.
 - c. Allow for combining up to four alarms using Boolean-type logic statements for outputting a single alarm.
 - 2. Alarm Events:
 - a. Over/undercurrent.
 - b. Over/undervoltage.
 - c. Current imbalance.
 - d. Phase loss, current.
 - e. Phase loss, voltage.
 - f. Voltage imbalance.
 - g. Phase reversal.
 - h. Digital input off/on.
- P. Control Power: 90- to 457-V ac or 100- to 300-V dc.
- Q. Communications:
 - 1. Power monitor shall be permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet.
 - 2. Local plug-in connections shall be for RS-232 and 100 Base-T Ethernet.
- R. Display Monitor:
 - 1. Back lighted LCD to display metered data with touch-pad selecting device.

2.3 LOW-VOLTAGE WIRING

- A. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 16 AWG copper, minimum.
 - 1. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 - 2. Ordinary Switching Circuits: Three conductors, unless otherwise indicated.
 - 3. Switching Circuits with Pilot Lights or Locator Feature: Five conductors, unless otherwise indicated.

4. Wires shall be all copper, stranded, unshielded twisted pairs. All wire shall be in conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- C. Identify components and power and control wiring according to Section 26 05 11 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- D. Label each power monitoring and control module with a unique designation.
- E. Grounding: Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- F. All cables shall be installed in conduits.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections:
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Section 01 00 00,"GENERAL REQUIREMENTS".
 1. Train Owner's management and maintenance personnel in interpreting and using monitoring displays. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 8 hours' training.
 2. Training Aid: Use approved final versions of maintenance manuals as training aids.
 3. Test and troubleshoot the system.

END OF SECTION

SECTION 260943
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of automatic and manual lighting controls (except for line-voltage toggle switches and line-voltage wallbox dimmers). The extent of the lighting controls work is indicated by drawings and schedules and as specified herein.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to other Division 26 sections for conductors / cables, grounding, raceways, electrical boxes and fittings and wiring devices required in connection with lighting controls.
- B. Refer to Section 26 27 26 for line-voltage wall-box dimmers and for line-voltage toggle switches.

1.4 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to installation and construction of lighting controls
- B. Underwriters Laboratories (UL):
 - 1. 508 – Standard for Industrial Control Equipment.
 - 2. 924 – Emergency Lighting and Power Equipment.
 - 3. 1008 – Transfer Switch Equipment
 - 4. 1472 – Standard for Solid-State Dimming Controls.
- C. All 0-10V dimming controls shall comply with IEC 60929.

1.5 SUBMITTALS

- A. Submit manufacturer's standard catalog data for each of the products specified. Include data on features, components, ratings and performance, including coverage patterns for each type of sensor. Include dimensioned drawings with isometric projections of components and enclosures.

- B. Provide samples of the equipment, devices and device wall plates for color selection and evaluation of technical features, if required by the Architect.
- C. Provide wiring diagrams detailing internal and interconnecting wiring for power, signal and control that distinguishes between field-installed and factory-installed wiring.

1.6 QUALITY ASSURANCE

- A. Manufacturer shall be regularly engaged in manufacturing of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. All devices shall be U.L. and CSA Listed specifically for the required loads.
- C. Lighting controls shall be listed, approved and comply with all national, state and local energy codes, including but not limited to the 2021 VECC. Transfer devices controlling emergency circuits shall be ETL listed to UL 924 and UL 1008.
- D. Comply with NEC and all local and state codes as applicable to electrical wiring work. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems and manufacturer specifications.
- E. Manufacturer shall maintain ISO 9001-2000 quality standard certification, including in-house engineering for product design activities.

1.7 WARRANTY

- A. The manufacturer shall provide a full one-year warranty (minimum) on all equipment provided and installed under this section.
- B. Warranty information and documentation shall be included in Submittals and Operation and Maintenance manuals turned over to owner at end of project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Exterior photoelectric switch (photocell) based on Tork; acceptable equals by Intermatic and Precision.
- B. Lighting Contactor based on Square D; acceptable equals by General Electric, Eaton and Siemens.
- C. Transfer Device based on Philips Bodine; acceptable equals by Philips Chloride and Hubbell Dual-Lite. Pay particular attention to functionality needed in 0-10V dimming emergency lighting applications and UL 924 and UL 1008 Listings. Other manufacturers will be considered if they meet the specifications of the basis of design product.

- D. Interior standalone low-voltage wired sensors and switches by Lutron, Acuity nLight, Leviton.
- E. Interior standalone low-voltage wireless sensors and switches by Lutron, Acuity nLight, Leviton.

2.2 EXTERIOR SENSORS

- A. Exterior Photoelectric Switch (Photocell):
 - 1. Solid state with SPST dry contacts rated for 2000 VA tungsten or 1800 VA inductive, complying with UL 773A. Voltage shall be 120 or 277V.
 - 2. Light-Level Monitoring Range: 1 fc to 15 fc with adjustable turn-on and turn-off levels; integral slide for light level adjustment.
 - 3. Time Delay: 120 seconds maximum.
 - 4. Cell: Cadmium sulphide, epoxy coated, 1 inch diameter.
 - 5. Mounting: Die cast zinc with 1/2 inch conduit mounting; accessories as required.

2.3 LIGHTING CONTACTORS

- A. Provide multi-pole lighting contactors with maximum continuous ampere rating and number of poles as indicated on drawings; contacts 100% rated for ballast and tungsten lighting and resistance loads; mechanically held, electrically operated; suitable for 277 or 120 volts, single phase, 60 HZ with coil voltage of 120 or 277 volts; field-convertible, silver-cadmium-oxide double break contacts. Install contactors in a NEMA – 1, surface-mounted enclosure. Provide auxiliary relay for 2-wire control, and provide HOA switch with pilot light in enclosure cover. Provide other accessory devices where indicated.

2.4 TRANSFER DEVICES

- A. Automatic Load Control Relay (ALCR): A device used to set normally dimmed or normally-off switched emergency lighting equipment to full power illumination levels in the event of a loss of the normal supply by bypassing the dimming/switching controls, and to return the emergency lighting equipment to normal status when the device senses the normal supply has been restored. The device shall consist of relay switching circuitry and fusing contained in one steel enclosure; shall operate at 120/277 VAC 60 HZ and shall have all inputs fused to 3A max. The device shall be UL 924 listed and listed for installation inside, on top of, or remote from the lighting fixture.
 - 1. Do not use this ALCR to transfer light fixtures from normal power to emergency power.
- B. Branch Circuit Emergency Lighting Transfer Switch (BCE LTS) or Automatic Transfer Switch (ATS): A device used in conjunction with an auxiliary generator or central inverter system to transfer power to designated lighting loads. The device senses the loss of normal power and, in response, transfers the lighting load to a designated emergency power source. The device will then bypass the dimming/switching controls and bring the light fixtures to full power illumination levels. When normal power is restored the device will transfer the light loads back to normal power and restore the lights to their last

controlled state. The device shall consist of relay switching circuitry, a test switch, normal and alternate power indicator lights contained in one steel enclosure; shall sense normal power at 120/277 VAC 60 HZ and shall be rated for 120/277 VAC 20A lighting load. The device shall be UL 924 and UL1008 listed and listed for installation indoor or damp locations.

- C. Note that for 0-10V dimming fixtures on emergency, the transfer device for multiple fixtures or for intelligent control systems must be used. Bypass the 0-10V signal to automatically bring fixture to full brightness when normal power is lost. Follow manufacturer's wiring diagrams carefully.

2.5 INTERIOR LOW-VOLTAGE WIRED SENSORS AND SWITCHES

- A. See schedule on drawings for interior ceiling and/or wall mounted low-voltage sensors, manual switches and load controllers. Connect per manufacturer's recommendations for individual room/area operation (lighting zoned per the floor plans). Controls shall be standalone, and not networked as a total building system; provide all programming tools needed for Owner to be able to re-program standalone rooms in the future.
- B. For manual switches, match wall mounted switch color and wallplate color/material to wiring devices and wallplates as specified in Section 26 27 26 or as directed by Architect or Engineer. Wall plates shall be by the same manufacturer as the wiring devices wall plates.

2.6 INTERIOR STANDALONE WIRELESS SENSORS AND SWITCHES

- A. See schedule on drawings for interior ceiling and/or wall mounted wireless sensors and manual switches. Connect per manufacturer's recommendations for individual room/area operation (lighting zoned per the floor plans). Provide minimum load controllers (MLC's) if necessary for proper operation.
- B. For manual switches, match wall mounted switch color and wallplate color/material to wiring devices and wallplates as specified in Section 26 27 26 or as directed by Architect or Engineer. Wall plates shall be by the same manufacturer as the wiring devices wall plates.

2.7 VARIOUS

- A. For all low-voltage controls, provide what is necessary for the Owner to make programming changes to the system after all initial programming has been performed by the manufacturer. This may be accomplished by a PC, a handheld programmer, or other means, as long as the Owner can easily make programming/setting changes at any time after initial programming without needing to contact a manufacturer's representative.
- B. For all 0-10V dimming controls, the performance curves for the 0-10V control and the 0-10V drivers shall not both be logarithmic. All 0-10V dimming controls shall include a relay in order to turn the circuit completely off.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. The Lighting Control equipment shall be installed and connected as indicated on the drawings and as directed by the manufacturer. The Contractor shall complete all electrical connections to all control circuits, sensors, devices, etc.
- B. All wiring shall be in accordance with the manufacturer's specifications. Wiring shall meet all local and state codes. All wiring shall be ground and short tested.
- C. Low-Voltage Cabling (including 0-10V): All low-voltage wiring/cabling shall be wired as Class 2 or Class 3 as applicable, following all requirements in NEC 725 for Class 2 or Class 3 circuits as applicable. Low-voltage wiring/cabling shall not share raceways with line-voltage wiring except where allowed by NEC 725.136(l), and all low-voltage wiring/cabling sharing a raceway shall have the same insulation rating. Cables shall be exposed where above A.C.T. ceilings - provide J-hooks spaced 6'-0" apart down corridor walls and D-rings spaced 6'-0" apart on structure where cables run from one side of the corridor to the other. Where J-hooks and D-rings are not required, cables shall be neatly and properly supported from the structure (not ductwork, piping or conduit) in such a way that they will not be strained as the building settles. Where cables are not above A.C.T. ceilings, provide raceways for cables according to Division 26 raceway requirements. Where cables must pass through partitions (such as floors or walls), provide conduit sleeves sized as required and bushed at both ends - cables are not allowed to poke through partitions. No conduit or sleeve shall be smaller than 3/4". Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals.

3.2 SENSOR INSTALLATION

- A. Install and aim occupancy/vacancy sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions. Contractor shall install sensors (occupancy/vacancy and photo) in locations and quantities as recommended by manufacturer. Regardless of quantities and locations of sensors shown on drawings, contractor shall provide sensors in quantities and locations to sufficiently cover areas in which sensors are located. If the engineer deems during a field inspection that there is not sufficient coverage or that photosensors are not properly reading the natural light in the space, the contractor will be responsible for adding and/or relocating sensors at no cost to the owner.
- B. Install exterior photocell either on roof facing north or on wall of north facing side of the building.

3.3 FIELD QUALITY CONTROL

- A. The contractor or manufacturer's representative shall perform the following functional testing in the presence of the Engineer (notify the Engineer at least 10 days in advance of

the start of testing, and certify in writing that the system is fully functional and operating correctly at least 10 days before the functional testing begins):

1. Ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the Sequence of Operations on construction documents and manufacturer's installation instructions.
2. Confirm that the placement, sensitivity and time-out adjustments for occupancy/vacancy sensors yield acceptable performance, and that lights turn off only after space is vacated (or are manually turned off) and do not turn on unless the space is occupied (and are manually turned on for vacancy sensors).
3. Confirm that time switches and programmable schedule controls are programmed to turn the lights off at the appropriate time.
4. Confirm that the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space.
5. All initial programming, set-up and testing shall be complete by the date of Substantial Completion.
6. Allow for a minimum of 4 hours of factory-authorized training to the Owner's personnel.
7. 30 to 60 days after initial programming, start-up and testing is done, a factory authorized technician shall return to the site to address any issues the Owner may have. Schedule visit with Owner's personnel.

3.4 O&M MANUAL

- A. Provide O&M Manual as specified in specification section 260100. Include both a paper copy and digital pdf copy of the O&M Manual.

3.5 COMMISSIONING

- A. Prior to occupancy, commissioning agent will inspect and verify that lighting controls are installed and calibrated properly, using section C408 (including sub-paragraphs) of the 2021 Virginia Energy Conservation Code. Commissioning agent shall also observe and document that all lighting controls are programmed and operating per the Sequence of Operations on the construction documents. Contractor shall be responsible to correct any items that are not functioning correctly.

END OF SECTION

SECTION 262100
ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the basic requirements of electrical installations for the electrical service entrance. Extent of the work shall be as indicated on drawings and schedules and as required by the NEC.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to other Division 26 sections for conductors and cables, raceways and electrical boxes and fittings required in connection with the service entrance, as well as the short circuit coordination study.
- B. Refer to other Division 26 sections for additional service entrance equipment not specified in this section.

1.4 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with the requirements of the local electrical utility company and applicable requirements of the 2020 NFPA-70 (NEC) pertaining to construction and installation of service entrances.

1.5 WORK INCLUDED, BUT NOT LIMITED TO

- A. Contractor to schedule and coordinate all service entrance requirements with the local utility company (Bedford Electric). Contact info: Charlie Epperly, cepperly@bedfordva.gov, 540-587-6107.
- B. Provide trenching and backfilling for secondary conduits.
- C. Provide secondary conduits and conductors from pad-mounted service transformer to service entrance equipment. Provide terminations in the service entrance equipment.
- D. Provide trenching and backfilling for primary conduits between new power pole and new pad-mounted service transformer.
- E. Provide and install building ground electrode system.

- F. Provide and install concrete pad for Bedford Electric pad-mounted service transformer. Coordinate with Bedford Electric for required concrete pad specification/drawings, based on the size of the transformer Bedford Electric is providing.
- G. Coordinate with Bedford Electric for service transformer characteristic and available fault current to provide to the Short-Circuit Coordination Study Engineer.

1.6 WORK NOT INCLUDED

- A. Bedford Electric to provide and install pad-mounted service transformer.
- B. Bedford Electric to provide all power pole and overhead line work for new high-voltage primary service.
- C. Bedford Electric to provide and install primary conductors.
- D. Bedford Electric to provide and install metering transformers CT's in new pad-mounted service transformer.
- E. Bedford Electric to provide and install meter base (socket/enclosure) and meter on side of their service transformer.
- F. Bedford Electric to provide and install meter control conduit, wiring, and connections between CT's in new pad-mounted service transformer and meter.
- G. Bedford Electric to provide primary and secondary terminations at the pad-mounted service transformer.
- H. Bedford Electric to provide and install all grounding at their pad-mounted service transformer.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE EQUIPMENT

- A. General: Provide service equipment which is U.L. listed as service equipment.
- B. Service equipment rated 600 volts or less shall be marked to identify it as being suitable for use as service equipment.
- C. Short Circuit Current Ratings: This Contractor shall contact the local power company to determine the available fault current at the pad mounted transformer. Utilize components which are individually rated not less than the short circuit current rating as determined from data received from the local power company and from data received from the short circuit coordination study.
- D. Conductors and Cables: Provide conductors and cables in accordance with Division 26 of these specifications.

- E. Service Entrance Rated Automatic Transfer Switches: Provide service entrance rated automatic transfer switches in accordance with Division 26 of these specifications.

PART 3 - EXECUTION

3.1 INSTALLATION OF SERVICE ENTRANCE EQUIPMENT

- A. Coordinate with other electrical work, including utility company wiring, as necessary to interface installation of service-entrance equipment work with other work.

END OF SECTION

SECTION 262213
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of the low-voltage distribution transformers as indicated by drawings and schedules and as specified herein.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to low-voltage distribution transformers.
- B. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- C. NEMA Compliance: Comply with applicable portions of NEMA St. 1 and St. 20.
- D. ANSI Compliance: Comply with applicable requirements of ANSI Standards C57-Series pertaining to power/distribution transformers.
- E. NETA Compliance: Comply with ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment.
- F. U.L. Compliance: Comply with applicable requirements of ANSI/UL 506 and 1561.
- G. IEEE Compliance: 519

1.4 SUBMITTALS

- A. Submit manufacturer's technical product data including dimensions, wiring and connection diagrams, rated KVA, frequency, primary and secondary voltages, percent taps, polarity, X/R ratio and impedance. Furnish factory certification for each size transformer to be installed of the following:
 - 1. Transformer performance efficiency at indicated loads
 - 2. Percentage regulation at 100% and 80% power factor
 - 3. No-load and full-load losses in watts
 - 4. Percent impedance at 75 degrees C

5. Hot-spot and average temperature rise above 40 Deg. C ambient temperature
6. Sound level in decibels, including standard and low noise transformers

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Transformers shall be manufactured by one of the following:

1. Acme Electric.
2. General Electric Company.
3. Eaton Corporation/Cutler-Hammer.
4. Siemens Energy & Automation, Inc.
5. Square D/Schneider Electric.

2.2 TRANSFORMERS

A. General Distribution Dry Type: Provide factory-assembled, general-purpose, dry-type distribution transformers; of sizes, characteristics, and rated capacities indicated. Provide terminal board with crimp type connectors. Limit terminal compartment temperature to 75 degrees C when transformer is operating continuously at rated load with ambient temperature of 40 degrees C. Windings shall be copper or aluminum. Provide wiring connections suitable for copper or aluminum wiring. Integrally mount vibration isolation supports between core and coil assembly and transformer enclosure; electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Do not exceed maximum sound-level ratings as determined in accordance with ANSI/NEMA standards. Provide transformers with fully-enclosed sheet steel enclosures and lifting lugs. Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel. Efficiency shall meet US Department of Energy (DOE) 10 CRF 431.

1. Provide ventilated NEMA 250, Type 2 transformers. Provide primary windings with 6 taps; (2) 2-1/2% increments above and (4) 2-1/2% increments below full-rated voltage for de-energized tap-changing operation. Insulate with Class 220 insulation and limit temperature rise to 150 degrees C when operating in an ambient temperature of 40 degrees C.
2. Low Noise Transformers: Transformers indicated as "low noise" shall have a factory-certified noise level at least 3 dB below the NEMA standard sound level for equal size transformers.
3. Transformer installed outside shall be provide with weather shield kit to make it weather-proof.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide a concrete pad for each floor-mounted transformer that is 6.5" high and 6" larger than the respective transformer on all sides. Install each transformer on 1/2" thick rubber isolation pads between transformer and concrete pad. Transformers shall have minimum 6" clearance on back and sides and the NEC 110.26 required clearance on the front.
- B. Connect dry-type transformers to wiring system with liquid-tight flexible metal conduit in lengths not exceeding 6 feet.
- C. Provide equipment identification name plates complying with Division 26 for identification for electrical systems.

3.2 CLEANING

- A. Prior to energization:
 - 1. Upon completion of installation, inspect interior and exterior of transformer.
 - 2. Remove paint splatters and other spots inside and outside of the transformer enclosure. Repair exposed surfaces to match original finish.
 - 3. Remove all wrenches, packing materials, and construction debris from inside the transformer.
 - 4. Use vacuum (with non-metallic attachments) to collect loose dust, dirt, and particles from inside the transformer enclosure and around the exterior of the transformer enclosure.
 - 5. Do not use compressed air to assist in cleaning. Using compressed air is likely to spread contamination and damage insulation.
 - 6. Accumulated dirt, oil, or grease might require a solvent to be removed. Solvents used for cleaning of electrical equipment shall be selected carefully to ensure compatibility with materials being cleaned. Do not use any liquid cleaners, include spray cleaners, unless specified by the transformer manufacturer, because of the risk of residues causing damage, interfering with electrical or mechanical functions, or compromising the integrity of the insulation surfaces. Allow sufficient time for drying after cleaning transformer with solvents. Wear the required PPE when working with potential hazardous solvents; refer to solvent material data sheets.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization:
 - 1. Prior to energization of transformer, check all accessible connections to manufacturer's tightening torque specifications.

2. Prior to energization of transformer, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
 3. Prior to energization of transformer, check for electrical continuity of circuits and for short-circuits.
- B. Certification: This Contractor shall certify in writing to the Architect that the above checks were made, including date of the checks and results.
- C. Upon completion of installation, energize transformer and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance, otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of the panelboards. Extent of panelboard work is indicated by drawings and schedules and as specified herein.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to installation, and construction of electrical panelboards and enclosures.
- B. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- C. U.L Compliance: Comply with applicable requirements of UL 67, "Electrical Panelboards," and UL's 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide units which are U.L. Listed and labeled.
- D. NEMA Compliance: Comply with NEMA Stds. Pub. No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub. No. PB 1, "Panelboards," and Pub. No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards.
- B. Shop Drawings: Submit manufacturer's drawings indicating the following:
 - 1. Dimensional data, including gutter dimensions.
 - 2. Circuit protective device schedule indicating type, frame, trip, interrupting rating; circuit numbering and arrangement to match that indicated on contract drawings as much as possible.
 - 3. Bus rating and bracing.
 - 4. Lug location and capacity.
 - 5. Provisions for future, breakers or switches.
 - 6. Caution Label in Panelboards with Ground Fault and/or Arc Fault circuit breakers to read "DO NOT INSTALL SHARED NEUTRALS ON GROUND FAULT OR ARC FAULT CIRCUIT BREAKERS".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with all requirements, panelboards shall be manufactured by one of the following:
1. Eaton Corporation/Cutler-Hammer.
 2. Siemens Energy & Automation, Inc.
 3. Square D/Schneider Electric.
 4. General Electric Company

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; designed and constructed in accordance with published product information; equipped with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated. Panelboards and circuit protective devices shall be marked to indicate that terminal provisions are based on the use of 75 degrees C rated, insulated conductors for all terminations.
- B. Panelboards: Provide dead-front safety type panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-turn solderless mechanical type lug connectors suitable for copper or aluminum conductors. Provide copper or aluminum phase bus bars and full-sized neutral bus bars, unless noted otherwise. Ground bus bars shall be un-insulated and bolted to the inside of the enclosure. All bus bars (phase, neutral and ground) shall be of the same material. Only a single neutral or ground conductor is permitted to be connected to a lug screw in the respective neutral or ground bus bar within a panelboard. Provide additional or larger capacity neutral or ground bus bars for each panelboard where indicated. Provide spaces with all studs, bussing, and hardware for future circuit breakers without the necessity of installing additional parts or changing bussing.
- C. Panelboard Enclosures: Unless noted otherwise, provide galvanized sheet steel cabinet type enclosures, code-gauge, minimum 16-gauge thickness, minimum size 5-3/4" deep x 20" wide. Construct with multiple knockouts and wiring gutters. Provide front with hinged trim constructed of piano hinge down one side and adjustable trim clamps. Front shall have an integral door with keyed flush lock/latch and concealed hinges to provide access to the dead front portion of the circuit breakers and screws to release entire trim. Removing screws shall allow entire front to open along with integral door to provide full access to all wiring gutters without removing front. All panelboard enclosures shall be keyed alike. Equip with interior circuit-directory frames and cards with clear plastic covering. Fronts for flush mounted panelboards shall overlap cabinet by 3/4" all around; fronts for surface mounted panels shall be the same size as the cabinet. Provide baked gray enamel finish over rust inhibitor covering, except panels in all finished areas shall have a prime finish, ready for paint finish to match adjacent surface. Provide enclosures

which are fabricated by same manufacturer as panelboards, which mate properly with panelboards to be enclosed.

D. Circuit Protective Devices:

1. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
 - (1) Instantaneous trip.
 - (2) Long- and short-time pickup levels.
 - (3) Long- and short-time time adjustments.
 - (4) Ground-fault pickup level (only where specifically indicated), time delay, and I²t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Ground Fault Circuit Breakers (GFCI): Single-pole and two-pole configurations with a nominal 5 mA trip threshold and 0.025 sec trip time.
 - f. Ground Fault Equipment Protector (GFEP): Single-pole, two-pole and three-pole configurations with a nominal 30 to 300 mA trip threshold.
 - g. Arc Fault Circuit Breaker (combination type per NEC): Single pole and two-pole configurations with detection of line-to-neutral arcing at 75A and above and line-to-ground arcing at 5A and above.
2. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - a. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - b. Ground Fault Protection: Integrally mounted relay and trip unit, push-to-test feature and ground-fault indicator.
 - c. Arc Fault Protection: Combination type AFCI breaker, push-to-test feature and arc-fault indicator.
 - d. Shunt Trip: 120V trip coil energized from separate circuit.
 - e. Multipole units enclosed in a single housing or factory-assembled shall operate as a single unit.

- E. Short Circuit Current Ratings: This Contractor shall contact the local utility company to determine the available fault current at the pad mounted transformer. Utilize components which are individually rated not less than the short circuit current rating as determined from data received from the local utility company and from the short circuit coordination study.

Series rating is not acceptable. Short circuit current rating shall be as required above and shall be a minimum of 10,000 amps on 208/120 or 240 panels and 14,000 amps on 480/277 panels unless noted otherwise.

- F. Circuit Breaker Lock: Provide approved circuit breaker lock-on device for the following equipment:
 - 1. All Fire Alarm System equipment, including but not limited to Fire Alarm Control Panel and remote (NAC) panels. Breakers shall be red and identified as "FIRE ALARM CIRCUIT".
 - 2. Sprinkler System: Dry-pipe air compressor.
 - 3. Exit signs.
 - 4. Egress lighting fixtures.
 - 5. Other equipment as shown on the Drawings or as required.
- G. Panelboard Surge Protective Device (SPD): See specification section 26 43 13 SURGE PROTECTIVE DEVICES (SPD) for SPD requirements.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS

- A. Coordinate installation of panelboards and enclosures with cable and raceway installation work.
- B. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure and plumb. Mount recessed panelboards with front uniformly flush with wall finish.
- C. Provide properly wired electrical connections within enclosures.
- D. Type panelboard's circuit directory card upon completion of installation work. Indicate panel designation, phase, voltage, and (for each circuit) type of load and location on the directory. Use Owner's room numbers, not those on the construction documents.
- E. Unless noted otherwise on the drawings or in the coordination study, all adjustable trip breakers shall have their long-time pick-up set to 100%. For breakers that have long-time pick-up set to less than 100%, provide label indicating what the setting is and that the wiring has been sized for this; also provide restricted access per NEC 240.6(C). A factory-authorized representative shall perform field adjustment of protective devices as required to place the equipment in final operating condition. Contractor shall notify Design Engineer once all breakers have been adjusted for field verification approval.
- F. Install filler plates in unused, open circuit breaker spaces.
- G. For flush mounted panelboards, stub four 1-inch empty conduits from panelboard up into accessible ceiling space or space designated to be ceiling space in the future. Also, stub four 1-inch empty conduits down into raised floor space or below slab when not on grade. Bush the ends of the conduits.

- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Apply sealant around all exterior mounted panelboards to provide weatherproofing and pest control; refer to sections of Division 7.
- J. Provide equipment/system identification nameplates complying with Division 26 in accordance with panelboard schedules on drawings. Inside each panelboard, the voltage, system, amperage and AIC ratings must be clearly labeled.
- K. Provide field marking to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. Provide arc flash warning label per the arc flash hazard analysis.

3.2 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Prior to energization:
 - 1. Upon completion of installation, inspect interior and exterior of panelboard.
 - 2. Remove paint splatters and other spots inside and outside of the panelboard enclosure. Repair exposed surfaces to match original finish.
 - 3. Remove all wrenches, packing materials, and construction debris from inside the panelboard.
 - 4. Use vacuum (with non-metallic attachments) to collect loose dust, dirt, and particles from inside the panelboard enclosure and around the exterior of the panelboard enclosure.
 - 5. Do not use compressed air to assist in cleaning. Using compressed air is likely to spread contamination and damage insulation.
 - 6. Accumulated dirt, oil, or grease might require a solvent to be removed. Solvents used for cleaning of electrical equipment shall be selected carefully to ensure compatibility with materials being cleaned. Do not use any liquid cleaners, include spray cleaners, unless specified by the panelboard manufacturer, because of the risk of residues causing damage, interfering with electrical or mechanical functions, or compromising the integrity of the insulation surfaces. Allow sufficient time for drying after cleaning panelboard with solvents. Wear the required PPE when working with potential hazardous solvents; refer to solvent material data sheets.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization:
 - 1. Prior to energization of panelboard, check all accessible connections to manufacturer's tightening torque specifications.
 - 2. Prior to energization of panelboard, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

3. Prior to energization of panelboard, check for electrical continuity of circuits and for short-circuits.
- B. Certification: This Contractor shall certify in writing to the Architect that the above checks were made, including date of the checks and results.
- C. Upon completion of installation, energize panelboard and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance, otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 262726
WIRING DEVICES AND MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of wiring devices and miscellaneous equipment. The extent of this work is indicated by drawings and in these specifications

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to other Division 26 sections for requirements for electrical installations, conductors and cables, grounding and bonding, and raceway and boxes which are required in conjunction with wiring devices and miscellaneous equipment.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliance: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to installation and wiring of electrical wiring devices.
- B. U.L. Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation and wiring devices. Provide wiring devices which are U.L. Listed and U.L. Labeled.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Std. 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
- D. NEMA Compliance: Comply with applicable portions of NEMA Stds. Pub. Nos. WD 1, "General Purpose Wiring Devices", and WD 5, "Specific Purpose Wiring Devices".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on wiring devices and miscellaneous equipment, including manufacturer's standard colors, descriptive literature and recommended installation instructions on each electrical item specified. Mark wiring device cut sheets for applicable NEMA, U.L. and Federal Specification compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide wiring devices of one of the following:

1. Receptacles and Switches: Bryant, Eaton Arrow/Hart, Hubbell, Leviton, Pass & Seymour.
2. Wallplates: Bryant, Eaton Arrow/Hart, Hubbell, Leviton, Pass & Seymour.

B. Provide miscellaneous equipment of one of the following:

1. Poke-thru Assemblies: Hubbell, Steel City, Wiremold.

2.2 WIRING DEVICES

A. General:

1. Provide factory-fabricated wiring devices, of types and electrical ratings for applications indicated. Color selections for all wiring devices and plates shall be from manufacturer's standard white, ivory, light almond, gray, red, brown or black colors, verified with the Architect by the Contractor (except where colors are noted below) before device order is released. The selected color or colors may not be the same in all spaces in the project.
2. Wiring devices shall be grounding type and shall be industrial specification grade, construction specification grade or heavy-duty specification grade. Switches shall comply with Federal Specification Standard WS-896 and receptacles shall comply with U.L. Standard 498 and Federal Specification WC-596.

B. Receptacles:

1. Duplex: Provide duplex receptacles with non-tracking thermoplastic polyester and/or nylon case; color as selected by Architect; triple-wipe power contacts .031 in. nominal; break-off tab for split wiring; auto-grounding clip; metal plaster ears; side wiring with spring-loaded, screw-activated pressure plate; NEMA configuration 5-20R. Receptacles shall be straight blade style.
2. Controlled Duplex: Same as duplex receptacles except the receptacles must include the text "CONTROLLED" permanently marked on the face of the device along with the NEMA-approved controlled receptacle marking symbol per NEC 406.3 (E). Controlled receptacles are noted by the letter "C" on the drawings.
3. Ground Fault Duplex: Provide ground fault duplex receptacles with non-tracking thermoplastic polyester and/or nylon case; color to match duplex receptacles in same area; red for receptacles connected on emergency circuits; side wiring with spring-loaded, screw-activated pressure plate; "feed-through" type capable of protecting connected downstream outlets; grounding type UL-rated Class A, Group 1; solid-state ground fault sensing and signaling with 5 milliampere ground-fault trip level; NEMA configuration 5-20R. Receptacles shall be straight blade decorator style.
4. Provide receptacles requiring current, voltage or configuration different from duplex receptacles as indicated. Provide with quality, material and workmanship at least equal to that specified for duplex receptacles.

5. Combination Duplex and USB Receptacles:

- a. Type 1: Provide combination duplex receptacle with one Type A and one Type C, 5.1A, vertical, USB ports that is 3.1, 3.0, 2.0, and 1.1 USB cable compatible; non-tracking plastic or nylon case; color to match duplex receptacles in same area; side or back wired; NEMA configuration 5-20R.
- C. Plugs: Provide plugs where noted or required, grounding-type, adjustable cord clamp, NEMA configuration and blades to match receptacle where noted.
- D. Connectors: Provide connectors where noted, grounding-type, double wipe contacts, adjustable cord clamp, NEMA configuration to match mating plug where noted.
- E. General Use Switches: Provide toggle switches where indicated. Switches shall be 120/277 volts AC; quiet-type; color as selected by the Architect; side wired; non-tracking case; undercut binder head screws; silver/cadmium alloy contacts with bronze spring arm; 20 ampere rating; SPST.
- F. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and ganging as required and cutouts as required for specified devices. Select wall plates of style which mate and match wiring devices to which attached. Unless stainless steel, color shall match associated wiring device except in unfinished spaces. Architect to select type of plate to provide. All plates shall be by the same manufacturer unless specifically noted otherwise. Construct with metal screws for securing plates to devices; screw heads shall match finish of plates. Provide plates possessing the following additional construction features:
 - 1. Unbreakable Polycarbonate Thermoplastic.
 - 2. Steel plate, Type 302 stainless, 0.032" thick. Where installed on 2" wide mullions, wall plate shall be 1-3/4" wide.
 - 3. Weatherproof Duplex Receptacle Wallplates: Wallplates for weatherproof receptacles with the designation "WP" where indicated on drawings or where required by NEC shall be UL listed and NEMA 3R rated while outlet is in use or not used. The receptacle shall also be listed as weather-resistant type. The cover shall be single-gang or double-gang for two devices and shall not protrude over 4.5" from wall surface. Each cover shall be complete with required sealing gaskets, and stainless steel mounting screws. Covers shall capability to allow the passage of two flexible cords. Mount wallplates with long dimension vertical, unless noted otherwise. Wallplates shall be identified as "extra heavy duty" where required by NEC 406.9(B)(1). Wallplate cover units shall be as manufactured by Arlington Industries, Inc. or Taymac Corporation, or approved equal. Where mounted on mechanical equipment, provide "bubble" type weatherproof-while-in-use cover. Architect to select color finishes.

2.3 MISCELLANEOUS EQUIPMENT

- A. Poke-thru Assemblies: Provide factory-assembled poke-thru combination devices suitable for above grade level for power and communications and for use in floors with a UL fire resistance rating of 1, 1-1/2 and 2 hours. The integral firestop shall also be

rated as a cold smoke barrier to prevent passage of smoke where heat is not present. Provide units with separation barrier between power and communication throughout the unit. Units shall be complete with proper length of single divided conduit for floor thickness encountered on the project, and below floor accessible junction boxes or divided junction box. Each complete unit shall be self-supporting without the attachment of above-floor fittings. The activation cover of each assembly shall be manufactured of die-cast aluminum alloy and shall be capable of being powder coated or plated. Coat finish shall be textured, two-stage epoxy paint in color finish to be selected by Architect. The activation cover shall be a maximum of 7 1/2" in diameter. The activation cover shall be flush with the finished floor with a maximum thickness not greater than 5/8" from the base of the cover to the top. The activation cover slide holder shall be manufactured from textured PVC and be color finish to be selected by Architect. The activation slide cover shall be a maximum of 4 5/8" in diameter. The activation slide cover shall provide spring loaded slide that snaps back in place when not in use to protect the flush mounted power receptacle. The activation slide cover shall also provide a two-level slide cover system for the telecom jacks to provide individual access and to protect jacks when not in use. Each activation cover shall also provide locations to adhere labels to identify both power and communication circuits. Provide the following types of poke-thru assembly units:

1. Type P1: 4-gang poke-thru floor box with two 20-amp deluxe NEMA 5-20R receptacles, barrier between power and communications sections, two 8-port keystone jack. The complete assembly shall be 6AT series as manufactured by Legrand Evolution, or approved equal.
- B. Telecom/Power Poles: Provide factory-assembled telecom/power poles of types, sizes, and ratings indicated; for use with telecom and power systems installed above suspended ceilings. Construct with provisions for one 50-pair telecom cable and with (2) 20-amp, 125-volt, 3-wire receptacles. Isolate power section from telecom compartment with separating steel enclosure. Extend wiring from receptacles to junction box at top of pole where connections are made above suspended ceiling. Provide pole foot with carpet pad; also provide pole with ceiling tile trim pad. Color of pole and devices shall be as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

- A. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- B. Install wiring devices only in electrical boxes which are set in wall at depth not greater than permitted by NEC, and which are clean and free from excess building materials, dirt and debris.
- C. Install stainless steel or unbreakable polycarbonate wallplates as specified by Architect.

- D. Install wall plates square and plumb with building lines.
- E. Mount all duplex receptacles vertically, with ground slot up, at mounting height as indicated in the Electrical Legend, unless noted otherwise. All receptacles shown at counter locations shall be mounted at height as indicated by an asterisk, unless noted otherwise. Only where there is a conflict with a mirror or medicine cabinet in Bathroom or Toilet counter locations the receptacle(s) shown shall be mounted horizontal with ground slot to the left. Center these receptacles between top of backsplash and bottom of mirror or cabinet.
- F. GFCI receptacles shall be readily accessible in locations required by NEC 210.8.
- G. Install wiring devices after wiring work is completed. Provide protective cover over each wiring device installed prior to painting operations.
- H. Install wallplates after painting work is completed and remove all protective covers.
- I. Apply sealant around all exterior mounted electrical devices (receptacles, photocells, switches, etc.) to provide weatherproofing and pest control; refer to Division 7 for joint sealers.
- J. Provide labels on all receptacles and light switches with panel-circuit powering the receptacle and light switch.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES

- A. Upon installation of wallplates and receptacles, make proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty or overloaded plugs.

3.3 TESTING

- A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices to demonstrate compliance with requirements. Following energizing, a polarity test shall be made on all receptacles to determine that all receptacles have been properly connected and that grounding conductors are continuous throughout all outlets. This Contractor shall certify in writing to the Architect that the testing has been completed and all receptacles are wired properly.

END OF SECTION

SECTION 262813 FUSES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing and installation of low voltage circuit protective devices or fuses. Extent of the work is indicated on drawings and as required by the NEC.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. UL Compliance and Labeling: Comply with applicable provisions of UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are U.L. Listed and Labeled.
- B. NEC Compliance: Comply with 2020 NFPA-70 (NEC) as applicable to construction and installation of fusible devices.
- C. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- D. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 "Low-Voltage Cartridge Fuses 600 Volts or Less".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data on fuses used on this project, including specifications and electrical characteristics. In addition, include voltages and current ratings, interrupting ratings, current limitation ratings, and time-current trip characteristics curves.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Obtain all fuses used on the project from a single manufacturer. Provide fuses by Cooper Bussmann, Mersen or Littelfuse.

2.2 FUSES

- A. General: Except as otherwise indicated, provide NEMA FU 1 nonrenewable cartridge fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics as indicated or required to suit the equipment served, which comply with manufacturer's standard design and materials, and constructed in accordance with published product information and with industry standards and configurations.
- B. Extra Materials: For all types and ratings required, furnish additional fuses amounting to one unit for every 10 installed units, but not less than one set of 3 of each size and type. Provide a metal cabinet with lockable door to house all extra fuses, plus 25% spare capacity and fuse pullers for each size of fuse.
- C. Class RK5 Time-Delay Fuses: Provide UL Class RK5 time-delay fuses rated 250 or 600 volts as applicable, 60 Hz, with 200,000 RMS symmetrical interrupting current rating, Bussmann "Fusetron", FRN/FRS, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF FUSES

- A. Provide fuses in all fusible devices. Size of fuses shall be as noted or in accordance with fuse manufacturer's tables for back-up motor running protection. Install fuses so rating information is readable without removing fuses. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing; installation and connection of low voltage disconnect switches and enclosed circuit breakers. Extent of the work is indicated on drawings and schedules and as required by the NEC.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to construction and installation of disconnect switches and enclosed circuit breakers.
- B. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- C. U.L. Compliance: Provide with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide switches and circuit breakers which are U.L. Listed and U.L. Labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub. No. KS 1, "Enclosed Switches", and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

1.4 SUBMITTALS

- A. Submit manufacturer's descriptive literature and recommended installation instructions on enclosed switches and circuit breakers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide enclosed switches and circuit breakers by one of the following:
 - 1. Square D /Schneider Electric Co.
 - 2. Cutler-Hammer, Inc./Eaton Corporation

3. General Electric Co.
4. Siemens Energy & Automation, Inc.

2.2 SAFETY SWITCHES

- A. Surface-mounted, general-duty or heavy-duty as applicable, horsepower-rated, fusible or non-fusible as indicated, safety switches with lugs suitable for copper or aluminum conductors and electro-silver plated current carrying parts, and with equipment ground bus with appropriate lugs. Fusible switches shall be provided with spring-reinforced fuse clips to reject all fuses except Class R current limiting type; fuse each phase. Switches shall have hinged door with defeatable interlock to prevent door from being opened in "ON" position; operating lever arranged for padlocking in the "OFF" position; arc quenchers; capacity and characteristics as required; non-teasable quick-make and quick-break mechanism; dead front; line side shield.
- B. Provide a set of auxiliary contacts for disconnects serving VFD's, to send a "disable" signal to the VFD when the disconnect is opened.
- C. As a Contractor-option for equipment rated below 1/2 horsepower, provide horsepower-rated, fusible or non-fusible as indicated, toggle-type switches with provisions for padlocking in the "OFF" position, and with number of poles and voltage as indicated.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. NEMA AB 1, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Current-Limiting Circuit Breakers where noted: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK5.
 4. GFCI Circuit Breakers where noted: Single- and two-pole configurations with 30 mA trip sensitivity.
- B. Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 1. Lugs: Suitable for number, size, trip ratings, and material of conductors.
 2. Ground-Fault Protection where noted: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature and ground-fault indicator.
 3. Integral shunt trip device for elevator mainline feeder disconnect where noted: 120V trip coil energized from separate circuit.
 4. Equipment ground bus with appropriate lugs.

2.4 ENCLOSURES

- A. Listed for environmental conditions of installed locations, including:
 - 1. Indoor General Locations, except where noted below: NEMA Standard 250, Type 1 surface mounted, except where noted as flush.
 - 2. Indoor Damp or Wet Locations: NEMA Standard 250, Type 4, surface mounted.
 - 3. Outdoor Locations: NEMA Standard 250, Type 3R, surface mounted.
 - 4. Food Service Areas: NEMA Standard 250, Type 4X, stainless steel, surface mounted.
 - 5. Elevator Equipment Rooms or Elevator Shafts: NEMA Standard 250, Type 12 surface mounted.

PART 3 - EXECUTION

3.1 INSTALLATION OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Provide safety switches for all motor appliances for the project where indicated and required by the NEC.
- B. Coordinate enclosed switch and circuit breaker installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- D. Install safety switches for use with motor-driven appliances, motors and controllers within sight of controller position, unless otherwise indicated, on a nearby wall, on the equipment served, or on an adequately constructed metallic framework. Where safety switches and maintenance receptacles are located on equipment served, the switches and/or maintenance receptacles shall be located where directed by the manufacturer of equipment or at a location that will not interfere with access panels or louvers.
- E. Provide labels indicating size and type of replacement fuses, glued to inside of door on all fusible switches.
- F. Apply sealant around all exterior mounted safety switches, enclosed circuit breakers, and enclosures to provide weatherproofing and pest control; refer to Division 7 for joint sealers.
- G. Unless noted otherwise on the drawings or in the coordination study, all adjustable trip breakers shall have their long-time pick-up set to 100%. For breakers that have long-time pick-up set to less than 100%, provide label indicating what the setting is and that the wiring has been sized for this; also provide restricted access per NEC 240.6(C). A factory-authorized representative shall perform field adjustment of protective devices as required to place the equipment in final operating condition. Contractor shall notify Design Engineer once all breakers have been adjusted for field verification approval.

- H. Provide equipment identification name plates complying with Division 26 for identification for electrical systems.
- I. Provide field marking to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. Provide arc flash warning label per arc flash hazard study.

3.2 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Prior to energization:
 - 1. Upon completion of installation, inspect interior and exterior of enclosed switches and circuit breakers.
 - 2. Remove paint splatters and other spots inside and outside of the enclosed switches and circuit breakers enclosure. Repair exposed surfaces to match original finish.
 - 3. Remove all wrenches, packing materials, and construction debris from inside the enclosed switches and circuit breakers.
 - 4. Use vacuum (with non-metallic attachments) to collect loose dust, dirt, and particles from inside the enclosed switches and circuit breakers enclosure and around the exterior of the enclosed switches and circuit breakers enclosure.
 - 5. Do not use compressed air to assist in cleaning. Using compressed air is likely to spread contamination and damage insulation.
 - 6. Accumulated dirt, oil, or grease might require a solvent to be removed. Solvents used for cleaning of electrical equipment shall be selected carefully to ensure compatibility with materials being cleaned. Do not use any liquid cleaners, include spray cleaners, unless specified by the enclosed switches and circuit breakers manufacturer, because of the risk of residues causing damage, interfering with electrical or mechanical functions, or compromising the integrity of the insulation surfaces. Allow sufficient time for drying after cleaning enclosed switches and circuit breakers with solvents. Wear the required PPE when working with potential hazardous solvents; refer to solvent material data sheets.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization:
 - 1. Prior to energization of enclosed switches and circuit breakers, check all accessible connections to manufacturer's tightening torque specifications.
 - 2. Prior to energization of enclosed switches and circuit breakers, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
 - 3. Prior to energization of enclosed switches and circuit breakers, check for electrical continuity of circuits and for short-circuits.

- B. Certification: This Contractor shall certify in writing to the Architect that the above checks were made, including date of the checks and results.
- C. Upon completion of installation, energize enclosed switches and circuit breakers and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance, otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 262913
LOW-VOLTAGE MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of low voltage motor controllers (motor starters). Extent of the work is indicated on drawings and schedules and as required by the NEC.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 REFERENCES AND CODES

- A. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to wiring methods, construction, and installation of motor starters.
- B. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- C. U.L. Compliance: Comply with applicable requirements of UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," and UL 508, "Electrical Industrial Control Equipment" pertaining to installation of motor starters.
- D. U.L. Compliance: Provide motor starters and components which are U.L. Listed and labeled.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Std. 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to motor starters.
- F. NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub. No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," pertaining to motor controllers/starters and enclosures.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on motor starters including power, signal and control wiring diagrams.

- B. Maintenance Data: Submit maintenance data requirements and parts list for each motor starter and component, including "trouble shooting" maintenance guide. Include that data, product data and shop drawings in a maintenance manual in accordance with requirements of Division 1.

1.5 COORDINATION

- A. Coordinate layout and installation of motor starters with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain code required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate features, accessories, and functions of each motor starter with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Motor starters shall be manufactured by one of the following:
 - 1. Allen-Bradley Company
 - 2. Cutler-Hammer, Inc./Eaton Corp.
 - 3. General Electric Company
 - 4. Siemens Energy & Automation, Inc.
 - 5. Square D/Schneider Electric

2.2 MOTOR STARTERS

- A. General: Except as otherwise indicated, provide motor starters and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation. Size all starters complete with thermal overloads in accordance with the recommendations of the manufacturer of the equipment served. Install starters in NEMA 250, Type 1 enclosures, unless noted otherwise to comply with environmental conditions at installed locations, and coat enclosure in manufacturer's standard color finish.
- B. Magnetic Starters: Provide full voltage across-the-line type, unless otherwise indicated. Provide combination starters where indicated, which have integral non-fusible disconnect switches (general duty or heavy duty as applicable), integral fusible disconnect switches (general duty or heavy duty as applicable) with rejection type Class R fuse clips, or integral circuit breakers as indicated, with hinged door with defeatable interlock to prevent door from being opened in ON position, and with handles capable of being padlocked OFF. Provide individual 120 volt secondary control transformers of sufficient capacity to operate connected pilots, indicating and control devices, plus 100 percent spare capacity, located within the starter case. Primary voltage of control transformer shall match the motor power circuit voltage and

shall be connected on the same circuit as the motor with fuse protection for the transformer. Provide overload relay with common trip and reset device. Provide melting alloy thermal overload devices in each ungrounded line. Provide phase loss and phase reversal protection with contacts to de-energize the starter upon the loss of any phase or reversal of any phases. Make provisions for field installation of up to 3 NO and 4 NC contacts in addition to the holding interlock. Provide auxiliary contacts, relays, pilot lights, switches and other control devices, etc. as required by the sequence of control. Provide HOA switch and pilot lights. Coordinate coil voltage with sequence of control. Provide equipment ground bus with appropriate lugs.

- C. Provide 2-speed magnetic starters where indicated. Coordinate number of leads and windings with Division 23. In addition to magnetic starter features described above, also provide speed selector switch.
- D. Manual Starters: Provide manually operated type with full voltage controller for single-phase fractional horsepower motors, of sizes and ratings as required. Equip with manually operated quick-make, quick-break toggle mechanisms, and with one-piece melting alloy type thermal units. Starter shall become inoperative when thermal unit is removed. Provide starters with double break silver alloy contacts, visible from both sides of starter, red pilot light and toggle operator capable of being padlocked OFF.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS

- A. Motor starters shall be furnished for all motorized equipment included in this contract, unless the item of equipment is specified with starter or starters as a complete package by the manufacturer of the equipment. Verify the type of motor starter shown on the electrical drawings with that indicated in the mechanical and plumbing sequences of control. Immediately bring any discrepancies to the attention of the architect for resolution.
- B. Coordinate with other work, including motor and electrical wiring/cabling work, as necessary to interface installation of motor starters with other work. Approximate locations of HVAC and plumbing motors are shown on electrical drawings. See mechanical and plumbing drawings for exact locations, sizes and quantities.
- C. Provide manual motor starters for fractional horsepower motors less than 1/2 horsepower and magnetic motor starters for 1/2 horsepower and larger motors, unless noted otherwise.
- D. Provide fuses in each combination fusible combination type starter. Size of fuses shall be in accordance with fuse manufacturer's tables for back-up motor running protection.
- E. Apply sealant around all exterior mounted motor starters to provide weatherproofing and pest control; refer to Division 7 for joint sealants.

- F. Provide equipment identification name plates complying with Division 26 for identification for electrical systems.
- G. Provide field marking to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. Provide arc flash warning label per arc flash hazard study.

3.2 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Prior to energization:
 - 1. Upon completion of installation, inspect interior and exterior of motor starter.
 - 2. Remove paint splatters and other spots inside and outside of the motor starter enclosure. Repair exposed surfaces to match original finish.
 - 3. Remove all wrenches, packing materials, and construction debris from inside the motor starter.
 - 4. Use vacuum (with non-metallic attachments) to collect loose dust, dirt, and particles from inside the motor starter enclosure and around the exterior of the panelboard enclosure.
 - 5. Do not use compressed air to assist in cleaning. Using compressed air is likely to spread contamination and damage insulation.
 - 6. Accumulated dirt, oil, or grease might require a solvent to be removed. Solvents used for cleaning of electrical equipment shall be selected carefully to ensure compatibility with materials being cleaned. Do not use any liquid cleaners, include spray cleaners, unless specified by the motor starter manufacturer, because of the risk of residues causing damage, interfering with electrical or mechanical functions, or compromising the integrity of the insulation surfaces. Allow sufficient time for drying after cleaning motor starter with solvents. Wear the required PPE when working with potential hazardous solvents; refer to solvent material data sheets.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization:
 - 1. Prior to energization of motor starter, check all accessible connections to manufacturer's tightening torque specifications.
 - 2. Prior to energization of motor starter, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
 - 3. Prior to energization of motor starter, check for electrical continuity of circuits and for short-circuits.
- B. Certification: This Contractor shall certify in writing to the Architect that the above checks were made, including date of the checks and results.

- C. Upon completion of installation, energize motor starter and demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills and meets requirements of equipment. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance, otherwise remove and replace with new units and retest.

END OF SECTION

SECTION 264313
SURGE PROTECTIVE DEVICES (SPD)

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements of surge protection devices (SPD) for low voltage power systems. SPDs intended for Service Entrance equipment installation shall apply to IEEE C62.41, Category C3 waveforms. Extent of surge protective devices work is indicated by drawings and as specified herein.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to other Division 26 sections for conductors/cables, electrical raceways, boxes and fittings which are required in conjunction with installation of SPD units.

1.4 REFERENCES AND CODES

- A. Source Limitations: Obtain surge protective devices and accessories through one source from a 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 the intended use.
- C. Comply with applicable requirements of the 2020 NFPA-70 (NEC), Article 285 pertaining to surge protective devices.
- D. Comply with applicable requirements of the 2020 NFPA-780 – Standards for the Installation of Lightning Protection Systems, Section 4.20 pertaining to surge protective devices.
- E. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."
- F. Comply with IEEE C62.41, "IEEE Guide for surge voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 4th Edition, "UL Standard for Surge Protective Devices."

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated, include physical characteristics, rated capacities, peak-surge current ratings per mode and per phase, operating characteristics, MCOV and any furnished specialties and accessories.
- B. Product Certificates: Certificate from manufacturer certifying products furnished comply with UL 1283 and UL 1449 listing and classification.
- C. Furnish independent certified test reports.
- D. Furnish operational and maintenance data.

1.6 SURGE PROTECTIVE DEVICE LOCATIONS

- A. Provide surge protective devices within or at the building service entrance switchgear and switchboards. Also provide surge protective devices within or at secondary switchgear, switchboards and panelboards as indicated on the drawings or schedules.

1.7 MANUFACTURER QUALIFICATIONS

- A. All surge protective devices shall be manufactured by an ISO 9001-2001 certified company normally engaged in the design, development, and manufacture of such equipment. The certified company shall have been engaged in the commercial design and manufacture of SPD units for a minimum of ten (10) years. The manufacturer shall be represented by a firm that is located within 250 miles of the jobsite and has represented the manufacturer of the SPD units for a minimum of five (5) years.
- B. The surge protective device manufacturer shall provide unlimited free replacement of the entire SPD for all inoperable SPD units during the warranty period.

1.8 WARRANTY

- A. The manufacturer of the SPD units shall provide a ten year limited warranty from the date of substantial completion against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation, and maintenance instructions. The warranty shall cover events that damaged the SPD, when they should not have damaged it. The warranty shall cover all parts, labor, and material to return the unit to serviceable condition. A factory trained local representative located within 250 miles of the jobsite shall provide on-site labor and system testing, if required, during the warranty period. The local representative shall own and operate test equipment capable of determining the clamping voltages of the systems provided on the project as well as ground measurement test equipment.

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. Square D; Schneider Electric.
 2. DITECK Surge Protection
 3. General Electric Co.
 4. Cutler-Hammer, Inc.; Eaton Corporation.
 5. Current Technology, Inc.
 6. Liebert Corporation; a division of Emerson.

2.2 SURGE PROTECTIVE DEVICES

- A. Type 1 Surge Protection Device with the following features and accessories:
1. 20kA nominal discharge current.
 2. 200kA short circuit current rating (SCCR).
 3. AC Sinewave True Tracking Filter with EMI/RFI Filtering.
 4. Phase Loss Monitoring with visual status indicators.
 5. Thermal protective MOVs.
 6. Audible Alarm, Silencing Switch and Form C Dry Contacts.
 7. 10 Protection Modes: (3) line-to-line (L-L), (3) line-to-neutral (L-N), (3) line-to-ground (L-G), and neutral-to-ground (N-G).
 8. Surge Counter with reset button.
 9. Fuses rated at 200-kA interrupting capacity.
 10. Available in all common voltages and configurations.
 11. Nominal Discharge Current and Measured Limiting Voltage Tests.
 12. Connection Means: Permanently wired.
 13. Standard NEMA 1 enclosure for interior installations and NEMA-3R for exterior installations.
 14. Integral disconnect.
- B. Type 2 Surge Protective Device with the following features and accessories:
1. 20kA nominal discharge current.
 2. 100kA short circuit current rating (SCCR).
 3. AC Sine wave True Tracking Filter with EMI/RFI Filtering.
 4. Phase Loss Monitoring with visual status indicators.
 5. Thermal protective MOVs.
 6. Audible Alarm, Silencing Switch and Form C Dry Contacts.
 7. 10 Protection Modes: (3) line-to-line (L-L), (3) line-to-neutral (L-N), (3) line-to-ground (L-G), and neutral-to-ground (N-G).
 8. Surge Counter with reset button.
 9. Fuses rated at 200-kA interrupting capacity.
 10. Nominal Discharge Current and Measured Limiting Voltage Tests.

11. Connection Means: Permanently wired.
 12. Integral disconnect.
- C. Type 3 Point-Of-Use Surge Protective Device: Refer to Division 26 for receptacles rated as surge protective devices.
- D. Type 4: Provide component surge protective devices and component assemblies for Type 1, Type 2 and Type 3 surge protective devices as required.
- E. Required Ratings:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, Main Entrance)	300 kA	150 kA
B	Exterior Locations, Distribution Panelboards, MCCs, Large Mechanical Equipment Panelboards, Panelboards Serving Exterior Equipment	200 kA	100 kA
A	Branch Locations (Panelboards, Busway)	100 kA	50 kA

- F. 2020 NFPA 780 Table 4.20.4 Maximum Allowed Voltage Protection Rating (VPR) of Mode of Protection Provided for Different Power Distribution Systems to Which SPD Can Be Connected. The maximum VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700V	1200V	1800V
L-L	1200V	1800V	4000V

- G. The listed Maximum Continuous Operating Voltage (MCOV) must be a tested value (minimum 115% of nominal for 480Y/277V, and minimum 125% of nominal for 208Y/120V).

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Surge protective device units shall be installed in strict accordance with the manufacturer's recommendations.
- B. Electrical Service, Distribution Panels and Panelboards:
1. Provide SPD units at each building service entrance switchgear or switchboards and at other primary or secondary panelboard locations as indicated on the drawings or schedules. When provided, the SPD units shall be located integrally or immediately adjacent to the switchgear, switchboard or panelboard being protected.

2. Where SPD's are indicated on the drawings as being integral to a piece of electrical gear, it shall be the contractor's option to provide an external SPD instead, located as closely as possible to the gear being protected and in a NEMA enclosure appropriate for the installation environment. The contractor shall be fully responsible to ensure that there is sufficient wall space for the external SPD, as the external SPD is his option – change orders will not be approved due to the contractor not coordinating this.
3. SPD units (except those in switchboards) shall be served with a dedicated 3-pole 60-amp circuit breaker in the gear being served and (5) #6 AWG minimum stranded low impedance connection cable to the breaker, unless the manufacturer recommends differently. The conductors serving SPD units shall be twisted together to reduce the SPD system input impedance, and shall be kept at the minimum length. SPD units shall be installed in strict accordance with the manufacturer's recommended practices and in compliance with NEC requirements. Measured impedance shall not be higher than 5 ohms on the ground for the service entrance SPD device. Where external, close nipple the SPD to the respective gear being protected.

3.2 GROUNDING CONNECTORS

- A. Connectors, splicers, and other fittings used to interconnect ground conductors, bond to equipment or grounding bars, shall be in accordance with NEC and U.L. requirements.
- B. All connectors and fittings shall be of the press crimp or compression set screw type.
- C. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

3.3 FINAL INSPECTION

- A. Each SPD installation shall be inspected by a licensed electrician to verify proper installation and operation in accordance with all applicable codes. Any deficiencies shall be corrected by the contractor. Provide written documentation of this inspection as part of the closeout documents/manual.

3.4 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, or panelboards to their sources until surge protective devices are installed and connected.

END OF SECTION

SECTION 265000
LIGHTING – INTERIOR, EXTERIOR AND EMERGENCY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation and connection of the interior, exterior and emergency luminaires, as well as battery-based emergency lighting equipment. Extent of the lighting systems work is indicated by drawings and schedules and as specified herein.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Division 31 for excavation and backfilling work required in connection with luminaires.
- B. Refer to Division 3 for concrete work required in connection with luminaires.
- C. Refer to other Division 26 sections for transfer devices, contactors, photocells, conductors / cables, raceways, electrical boxes and fittings required in connection with luminaires.

1.4 REFERENCES AND CODES

- A. Codes and Standards:
 - 1. Electrical Code Compliances: Comply with applicable requirements of the 2020 NFPA-70 (NEC) pertaining to installation and construction of lighting fixtures.
 - 2. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub. Nos. LE 1 and LE 2 pertaining to lighting equipment, as well as NEMA std. Pub. Nos. 1B, 4, 5 and FA 1 pertaining to emergency lighting.
 - 3. UL Compliance: Comply with UL standards, including Stds. 486A and B, pertaining to lighting fixtures. Provide lighting fixtures and components which are UL-listed and labeled.
 - 4. All drivers shall comply with NEMA 410 for inrush current.
 - 5. 0-10V dimming drivers shall comply with IEC 60929 as a current source.
- B. Lamp Requirements: All lamps shall meet or exceed the requirements of the National Energy Policy Act where applicable.

- C. All drivers shall meet or exceed ANSI end-of-life requirements.
- D. In addition to the above requirements, LED fixtures shall comply with the latest applicable editions of the following:
 - 1. UL Standard 8750 "Light Emitting Diode Equipment for Use in Lighting Products".
 - 2. IES Standard LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products".
 - 3. IES Standard LM-80 "Measuring Lumen Maintenance of LED Light Sources".
 - 4. IES Standard TM-21 "Projecting Long Term Lumen Maintenance of LED Light Sources".
 - 5. ANSI C78.377 "Specifications for the Chromaticity of Solid State Lighting Products".
 - 6. NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays or Systems".
 - 7. ANSI C62.41.2 "Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver lighting fixtures in factory-fabricated containers or wrappings which properly protect fixtures from damage.
- B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperature and humidity, laid flat and blocked off ground.
- C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data in booklet form with separate sheet for each light fixture type, assembled in "light fixture type" numerical or alphabetical order matching contract documents, with dimensional data and accessories for proposed light fixtures. The booklet shall also contain manufacturer's technical product data for each light fixture's driver that will be provided with that light fixture type. Driver's product data shall be marked-up (highlighted or red-line) to show compliance with Driver requirements below.
- B. Maintenance Data: Submit manufacturer's technical product data for each luminaire, pole and accessory, including a copy of the installation instructions for each type of luminaire installed. Include data in maintenance manual in accordance with requirements of Division 1.
- C. Extra Materials: For LED fixtures with replaceable LED modules/arrays, furnish one (1) spare of each type of module/array. Furnish one (1) spare driver of each light fixture type used. Label and deliver replacement stock as directed to Owner's storage space.

1.7 WARRANTY

- A. All drivers (including emergency) shall have a minimum 5-year manufacturer's warranty.
- B. All LED luminaires shall have a limited minimum 5-year manufacturer's warranty for the light engine(s) or array(s) and driver.
- C. All other items in this section shall have a minimum 1-year manufacturer's warranty.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to Division 1 for requirements in selecting products and requesting substitutions. ALL requests for substitutions, including value engineering, shall include catalog cuts for each luminaire type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires: Manufacturer's names and catalog numbers are indicated on the luminaire schedule on the drawings. Alternate luminaires will only be considered if submitted in accordance with the requirements of the supplementary instructions to bidders. Provide product data and catalog cuts or shop drawings as required above for each proposed alternate luminaire type.

2.2 LUMINAIRES

- A. General: Provide luminaires of sizes, types and ratings indicated, complete with but not limited to housings, poles, lamps, lamp holders, reflectors, drivers, starters and wiring. Ship luminaires factory-assembled with parts required for a complete installation. Design luminaires with concealed hinges and catches, with metal parts grounded as a common unit and constructed so as to dampen driver-generated sounds. Provide thermal protection for recessed luminaires. Provide luminaires which are identified as suitable for installation in direct contact with thermal insulation where such installations occur.
- B. Wiring: All wiring within luminaires shall have a minimum temperature rating of 90 degrees C and shall be sized in accordance with NEC.
- C. Lens: Provide nominal minimum 0.125" thick 7.8 oz./sq.ft. 100 percent virgin acrylic Type 12 pattern, plastic, UV stabilized lens for standard lensed 1'x4', 2'x4' and 2'x2' luminaires, unless noted otherwise.
- D. Pendants: All pendant mounting means, whether cable, chain, rod or stem, shall be provided in lengths as required to provide luminaire mounting heights as indicated.

E. Additional requirements for LED luminaires:

1. Color temperature shall be 4000K with minimum CRI of 80, unless indicated otherwise.
2. LED's shall be binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaires of the same type.
3. Mercury-free, lead-free, RoHS compliant.
4. Compliant with FCC 47 CFR Part 15 non-consumer RFI/EMI standards.
5. Light output shall be measured using the absolute photometry method following IES LM-79 and LM-80 requirements and guidelines.
6. Luminaires shall maintain at least 70% lumen output (L70) for a minimum of 50,000 hours.
7. Lumen output shall not depreciate more than 20% after 20,000 hours of use.
8. Thermally designed to not exceed the maximum junction temperature of the LED for the ambient temperature of the location in which the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found in the intended installation. Exterior luminaires shall be capable of operating in ambient temperatures of -20 deg. F to 122 deg F (-29 deg. C to 50 deg. C).
9. Luminaires shall operate normally for input voltage fluctuations of plus or minus 10%.
10. Maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
11. All connections to luminaires shall be reverse-polarity protected and provide high voltage protection in the event that connections are reversed or shorted during installation.
12. The failure of one individual LED shall not affect the operation of the remaining LED's in the luminaire.

2.3 DRIVERS

A. LED Drivers:

1. Unless specifically indicated otherwise, shall be of the 0-10V dimming type down to 10% light level. The performance curves for the 0-10V control and the 0-10V drivers shall both be linear, not logarithmic. Dimming shall occur down to the minimum level with no visible flicker or "popcorn effect". "Popcorn effect" is when the luminaire is on a preset dimmed level, and the LED's go to 100% prior to returning to the preset level when power is returned to the fixture.
2. Shall have rated life of minimum 50,000 hours.
3. Shall have minimum power factor of 0.9 and maximum crest factor of 1.5 at full input power and across specified voltage range.
4. Shall operate normally for input voltage fluctuations of plus or minus 10%.
5. Shall have maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
6. Shall have polarized quick-disconnects for wiring connections for field maintenance.

7. Shall have built-in fuse protection, with all power supply outputs either fuse protected or Polymeric Positive Temperature Coefficient (PTC)-protected per Class 2 UL Listing.
 8. Shall demonstrate no visible change in light output with a variation of plus or minus 10% change in line-voltage input.
 9. All dimmable LED drivers of the same manufacturer family/series shall track evenly across multiple light fixtures at all light levels.
 - a. Example: Say light fixture Type A is a 2'x4' light fixture with a dimmable driver that is used throughout an office building in multiple rooms. The Type A light fixture shall be provided from the approved manufacturer with the exact same dimmable LED driver in all the Type A light fixtures shipped/installed in the building. These drivers shall all be alike, so the low end and high end of the dimming ranges are all identical. These drivers shall all be alike, so the dimming curves dim at the same levels through the dimming range. Where any dimmable drivers are provided/shipped from the manufacturer that do not meet this requirement then the manufacturer shall replace the dimmable drivers (material and labor) at no cost to the owner.
- B. Other Dimmer Controls: Refer to Division 26 for Lighting Control Devices specification sections for dimming systems associated with local dimmer controlled luminaires.
- C. Voltages: Drivers shall be coordinated with circuit voltages as indicated on drawings. Some luminaire types may be connected on multiple voltages when utilized in different areas of the project.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify ceiling construction in all areas prior to ordering luminaires to determine if luminaire type called for is correct to fit ceiling encountered. Notify Architect if any discrepancies are found.

3.2 INSTALLATION OF LUMINAIRES

- A. Coordinate the location of luminaires with other installations (i.e. diffusers, registers, grilles, speakers, sprinklers, finish ceiling height, structural components, fire rating, etc.) located in the same space.
- B. Luminaires in mechanical and electrical rooms are shown for quantity and approximate location only. Coordinate final location with other work in the space to clear piping, ducts, valves and equipment. Some units may be required to be wall-mounted.
- C. Support all ceiling mounted luminaires that match the size of the layout of the ceiling grid from the building structural framing members or the ceiling framing system utilizing conduit stems, fixture studs, support clips, steel rods or bar hangers. If the ceiling framing system is used for support, install a minimum of two ceiling support system

rods or wires for each luminaire (on diagonally opposite corners of the fixture). Locate not more than 6 inches from fixture corners.

- D. Fixtures of Sizes Less than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- E. Fasten luminaires securely to structural supports, and ensure that pendant luminaires are plumb, level and square with ceiling and walls unless indicated otherwise. Provide individually mounted pendant luminaires longer than 24" with twin stem hangers, unless noted otherwise; provide stem hanger with ball aligners and provisions for minimum 1" vertical adjustment. Mount continuous rows of luminaires with one additional stem hanger more than the quantity of luminaires in the row.
- F. Fasten recessed luminaires mounted in lay-in ceilings to the adjacent T-bars by approved fasteners or clips that are UL listed for the application.
- G. Install recessed luminaires in plaster ceiling areas in rolled metal plaster frames.
- H. Support surface mounted luminaires greater than 24" in length at a point in addition to the outlet box fixture stud.
- I. Apply sealant around all exterior mounted light fixtures to provide weatherproofing and pest control; refer to Division 7 for joint sealants.

3.3 INSTALLATION OF LIGHTING POLES AND STANDARDS

- A. To protect finishes, use belt slings or rope (not chain or cable) to raise and set finished poles and standards.
- B. Where lighting poles/standards are indicated to be embedded in soil (direct burial), set poles to depth required for adequate structural support, but not less than 5'-6" below finish grade.
- C. Set poles and standards plumb. Support adequately during back-filling and when anchoring to foundations.
- D. Provide sufficient space encompassing hand access and cable entrance holes for installation of cables from underground where indicated.
- E. Install hinged-base poles so poles hinge away from pavement.

3.4 ADJUSTING AND CLEANING

- A. Clean luminaires of dirt, fingerprints, paint, dust and other debris upon completion of installation. Protect installed luminaires from damage during remainder of construction period.

3.5 FIELD QUALITY CONTROL

- A. At Date of Substantial Completion, for LED fixtures with built-in LED boards, replace boards or fixtures in which at least 5% of the individual LED's will not illuminate.
- B. Refer to sections of Division 1 for the replacement/restoration of lamps in interior luminaires, where used for temporary lighting prior to Date of Substantial Completion.

END OF SECTION

SECTION 270500
COMMON WORK RESULTS FOR COMMUNICATIONS

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 WORK INCLUDED

- A. Every item of labor, material, devices and appurtenances for installing a complete Electronic Communications Systems and other related systems included in Division 27 of the Specifications.
 - 1. Section 27 05 26 – Grounding and Bonding for Communications Systems
 - 2. Section 27 05 28 – Pathways for Communications Systems
 - 3. Section 27 05 53 – Identification for Communications Systems
 - 4. Section 27 20 00 – Data Communications
 - 5. Section 27 30 00 – Voice Communications
 - 6. Section 27 40 00 – Audio-Video Communications

1.3 RELATED WORK

- A. General: See all other portions of these Contract Documents and apply to those portions of work, relating to the Division 27 systems, the same as if repeated herein in its entirety. The Division 27 Trades shall provide and install all wiring, all equipment, all electronics, all software and accessories as specified and shown on the drawings and as needed to provide complete and operational systems. Division 27 Trades shall provide to Division 26 special boxes, cabinets, racks, hangers, and etc.; for installation.
- B. Division 23 – Mechanical
- C. Division 26 – Electrical
- D. Division 28 – Electronic Safety and Security

1.4 WORK NOT INCLUDED

- A. Provide roughing-in, including the empty boxes, conduit, pull strings, etc. under Division 26 for the following related Sections:
 - 1. Section 27 20 00 – Data Communications
 - 2. Section 27 40 00 – Audio-Video Communications

1.5 DRAWINGS

- A. Where conduit, equipment, devices and other electrical appurtenances are shown on the drawings, the general arrangement of such items on the electrical drawings shall be followed as closely as actual building construction and the work of other trades will permit. Because of the small scale of the electrical drawings, it is not feasible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the construction conditions affecting the work and provide fittings and accessories as required to meet actual conditions.

1.6 QUALITY ASSURANCE

- A. Equipment and material used in the project shall be new and undamaged. The installation shall fit into the space allotted and shall allow adequate, acceptable, clearances for entry, servicing, safety, and maintenance. The Contractors shall coordinate the work to ensure that the equipment may be moved into place without altering building components or other installations. All electronic communication systems (above) work shall be performed by a Commonwealth of Virginia Class-A licensed Electrical Contractor(s) whose technicians, mechanics, or tradesmen shall be skilled and certified in the trade involved. All Division 27 work shall be performed under the direct supervision of the equipment systems' authorized technician with a locally recognized and accepted master electrician's license. All work under Division 27 shall be provided by a single-source Division 27 vendor/subcontractor.
- B. Equipment and material in existing installations may be reused where specifically indicated on the drawings.

1.7 REFERENCES

- A. The complete installation and all materials and equipment under Division 27 shall conform to the current Commonwealth of Virginia Statewide Building Code including all applicable portions of the National Electrical Code (NEC) and all other governing codes, regulations and certifications. All wiring methods shall adhere to Division 27 specified wiring methods.
- B. All equipment used shall bear the Underwriters Laboratory (U.L.) label for the intended application, or other organizations label if acceptable to the Authority having jurisdiction and concern with product evaluation.
- C. In addition, the following codes, standards, and regulations shall apply to the complete installation and all materials and equipment. These are referred to by their accompanying abbreviations.
 - 1. National Electrical Code (NFPA No. 70) NEC
 - 2. National Electrical Manufacturers Association NEMA
 - 3. Underwriters Laboratories, Inc. UL
 - 4. Telecommunications Building Wiring Standards TIA/EIA
 - 5. All Systems' Installation Certification Compliance Documents for Installing Trades

- | | | |
|----|---|-------|
| 6. | National Fire Protection Association | NFPA |
| 7. | Uniform Federal Accessibility Standards | UFAS |
| 8. | Americans with Disabilities Act Accessibility Guideline | ADAAG |

- D. The above standards are intended as a minimum and shall be exceeded if required by the Contract Documents. In the event information contained in the Contract Documents conflicts with one of the above mentioned codes, the codes shall take precedence.

1.8 PERMITS, LICENSES, TAXES AND INSPECTION CERTIFICATES

- A. All permits, bonds, licenses, inspection fees and taxes required for the execution of the work shall be obtained and paid for by the Contractor. Under each phase of the Division 27 work, the Contractor shall furnish three copies of certificates of final acceptance to the Engineer from any inspection authority having jurisdiction.

1.9 REGULATIONS AND STANDARDS

- A. The completed installation and all materials and equipment shall conform to local ordinances and codes, other regulations and standards listed herein or in related sections. These are intended as a minimum and shall be exceeded if required by the specifications or the Drawings. In the event of conflict between the codes, standards, or regulations, and information contained in the Contract Documents, the applicable code, standards, or regulation shall take precedence.

1.10 SUBMITTALS

- A. Submit shop drawings, product data and samples in accordance with Division 1 for all items as specified in related sections of these specifications. One (1) electronic (PDF) copy of the submittal shall be submitted. One (1) electronic (PDF) copy of the submittal will be returned to the Contractor. If additional copies are required they will be the responsibility of the Contractor. Where drawings are submitted, the Contractor shall submit a minimum of two (2) sets of full scale prints. One (1) copy will be marked and returned to the Contractor, and the Contractor shall be responsible for all additional copies required for his use. All submittal data shall be correctly identified to show project name, and the exact model, style or size of item being submitted. Improperly identified submittals will not be reviewed by the Engineer. Each item submitted for review shall bear the Subcontractor's stamp which states that they have reviewed the submission, that it is complete, and that in their opinion it meets the contract requirements. Contractor's stamp shall identify the paragraph and page number for which the submittal is being made. Any submission which has not been reviewed and stamped by the Electrical Trade will not be reviewed by the Engineer. No reviews prior to award of Contract will be considered or accepted. No reviews prior to award of Contract will be considered or accepted, unless otherwise specified. Provide all submittals 60 days from notice to proceed. Owner shall be copied on submittals, reports and correspondence.
- B. Shop drawings, diagrams, catalog data and such other data necessary to fully describe and substantiate compliance with these Contract Documents shall be submitted as follows:

1. All the equipment and materials where submissions are specifically required by other Divisions of these Contract Documents.
 2. All the equipment and materials that are indicated with a [S] behind the product title. This shall include submission of the specified products equipment and materials.
 3. All the equipment and materials that are acceptable equal substitution.
 4. If submission is NOT required for the SPECIFIED products "shop drawings and product data" under 1. and 2. above, the Contractor shall NOT submit the SPECIFIED products "shop drawings and product data".
 5. Samples, in good working order, shall be submitted in accordance with Division 1, complete with all installation and service drawings and instructions. All samples will be returned at the submitter's expense unless otherwise indicated. Samples may be subject to destructive testing by Engineer.
- C. Operation and Maintenance manuals shall be submitted in accordance with Division 1 and shall include a copy of all accepted shop drawings, installation and maintenance data, operation instructions, parts lists, and the name, address and telephone number of supplier or nearest representative. All electrical and electronic devices, equipment and systems marked [O/M] in these specifications shall be included and all other such electrical and electronic items which will require servicing before the duration of its useful life has been reached. Manuals shall be presented to the Engineer for review and transmitted to the Owner before the final payment is recommended.
- D. Equivalents:
1. Not all of the Manufacturers, trade names and/or model numbers are indicated herein, or on the drawings.
 2. Unless definitely stated otherwise and upon complying with Division 1, the Contractor may use any article of equal appearance, which in their judgment is equal to the article that is specified and is accepted by the Engineer.
 3. Where three (3) or more manufacturers are named in the specifications for any item, the Contractor shall use one of the three (3) listed manufacturers. **No other manufacturers shall be reviewed or accepted.** Manufacturers that are listed first in these specifications and on drawings were used as a basis of design. Single manufacturers may be list for some products do the County standardizing on that specific equipment.
 4. It will be the responsibility of the Contractor to verify all connections, physical sizes and capacities of all other manufacturer's items, both named or proposed. If the equipment necessitates changes in power distribution, conduit, wiring, lighting, wiring, or any other building systems from that indicated on the drawings, the Contractor shall be responsible for all additional costs included and notify other trades of the changes. Where such changes are required, detail drawings indicating all required changes shall be submitted for review at the same time the manufacturers drawings are submitted for approval.
 5. Refer to Division 1 for substitutions.

- E. The ten day prior approval requirements of The Instructions to Bidders, AIA 701, are waived for this Division of the Specifications, and unless stated otherwise, the Contractor may use items that he deems as equivalent in quality and performance to the specified item subject to final acceptance of substituted items by the Engineer upon his review of shop drawings.
- F. Guarantee: Electronic Communication Systems equipment, materials and labor required by these specifications and accompanying drawings shall be guaranteed to be free from defective materials or workmanship for a period of one year after final acceptance of the project except extended warranties as specified elsewhere in these documents on specific items of equipment will be furnished by the Trade providing the equipment. Defects in material or workmanship occurring during this period shall be corrected with new material and equipment or additional labor at no cost to the Owner. Manufacturer's certificates of warranty shall be transmitted to the Owner before final payment is recommended.

1.11 WARRANTIES

- A. The Contractor shall warrant for a period of one year all work provided under the Contract to include, but not necessarily limited to, all systems, equipment, materials, and workmanship. This shall not be construed to limit any extended warranty periods of longer than one year for specific items or systems specified elsewhere in the Contract Documents.
- B. The warranty period shall commence on the date of acceptance by the Owner and shall cover all parts and labor as required to fulfill the warranty at no cost to the Owner.
- C. Refer to Division 1 for additional warranty requirements.
- D. Information on all warranties shall be included in the O&M manuals specified herein to be provided to the Owner.

1.12 COORDINATION OF WORK

- A. General: The contract documents indicate the extent and general arrangement of the communications systems. The Contractor shall be responsible for the coordination and proper relation of the communications systems work to the building structure and to the work of other trades. No additional compensation or extension of completion time will be granted for extra work caused by the lack of coordination.
- B. Cooperation: The Contractor shall provide dimensions and locations of all openings, shafts and similar items to the proper trades and install work as required so as not to interfere with, or delay, installation of systems under construction in the buildings.
- C. Locations of lines and equipment shall be determined from actual field measurements. The outlines of the building shown on the contract drawings are intended only as a guide to indicate relative locations of the electrical work. Refer to the existing buildings and structural components to determine actual measurements. If conflicts prevent installation of communications systems work at the locations indicated, minor

deviations shall be made subject to acceptance by the Engineer, and without additional compensation.

- D. Cutting and Patching: See Division 1 and Division 26.
- E. Roughing-In: Equipment, racks, cabinets, devices, and other similar items shall align vertically or horizontally with each other, the building structure and features thereof when it appears obvious and logical that they should. All mounting heights shall be within the limits of Commonwealth of Virginia USBC and ADAAG.
- F. Damage to Other Work: The Division 27 Trades are responsible for damage to other work caused by his work or workmen. Repairing of damaged work shall be done by the Trade who installed the work, and as directed by the Engineer; the cost of which shall be paid for by the Division 27 Trades.

1.13 ASBESTOS

- A. Asbestos Free Materials: The intention of these drawings and specifications is that there be no asbestos containing materials installed on this project. To the best of the Engineers' knowledge, none of the material or equipment specified herein or shown on the drawings contains asbestos. The Contractor shall make every effort to prevent any asbestos materials from being installed in or used on the construction of the project. At the completion of the project, the Contractor shall certify by letter that to the best of his knowledge, no asbestos containing materials were used for or in the construction of this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. General: Manufacturers and materials shall be as specified in subsequent sections of these specifications and as noted on the drawings. Similar types of equipment shall be the products of the same manufacturer unless specified otherwise.

2.2 SLEEVES AND INSERTS

- A. General: Sleeves and inserts shall be provided and correctly located in the structure, as required for the work.
- B. Inserts shall be steel and of proper size for loads encountered.
- C. All sleeves and conduits shall be firestopped by Division 26 as indicated in Specification Section 26 05 00.

2.3 ACCESS DOORS

- A. Provide for all junction boxes or any item requiring access. Doors shall be of sufficient size and so located that the concealed items may be serviced or completely removed

and replaced. Doors required for work shall be furnished as a part of this Division to the General Contractor for installation. Doors in acoustic tile ceilings shall be furnished in multiples of tile sizes. Doors are not required in exposed grid type ceilings where tiles are removable. Doors shall be metal access doors with cam lock, style to match ceiling or wall construction. Doors occurring in rated construction shall be fire rated U.L. labeled access doors correlated to preserve the integrity of the rated construction. Doors shall be prime finish steel except those in toilets, shower rooms, locker rooms, kitchens and other similar areas shall be aluminum with natural anodized finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Materials and equipment shall be installed in accordance with manufacturer's instructions to conform with the details and application as specified in subsequent sections of these specifications and indicated on the drawings.
- B. Supports: Provide necessary supports for all equipment and appurtenances as required; this includes, but is not limited to, frames or supports for items such as cabinets, switches, junction boxes, conduit, outlet boxes, and other similar items requiring supports. Foundation drawings, bolt setting information and foundation bolts shall be furnished by the subcontractors furnishing the equipment for all equipment required to be bolted to the floor, wall or above ceiling structure.
- C. Sleeves: Provided by Division 26.
- D. Temporary Requirements: Openings in equipment shall be kept capped at all times until connection is made to the system. The ends of all conduits and equipment openings shall be kept capped properly with approved devices. Approved devices are items such as specially molded plastic caps and sheet metal caps.
- E. Access Doors: Provide access doors for all concealed electric equipment, pull boxes, junction boxes or any item requiring access. Doors shall be of sufficient size and so located that the concealed items may be serviced or completely removed and replaced. Doors required for Division 27 work shall be furnished by Electrical Trade to the Contractor for installation. Doors in acoustic tile ceilings shall be furnished in multiples of tile sizes. Doors are not required in exposed grid type ceilings where tiles are removable.
- F. Painting: All work under this Division shall be painted in accordance with Section 27 05 53, Painting, Marking and Identification of Equipment.

3.2 FIELD QUALITY CONTROL

- A. Verification [V]: Upon completion of the project, the Contractor shall submit a separate letter of certification (or compliance) to the Owner/Engineer that each of the following systems or equipment functions properly, conforms to all requirements of these specifications and all requirements of the manufacturer of the systems.

1. Section 27 20 00 – Data Communications
2. Section 27 30 00 – Voice Communications
3. Section 27 40 00 – Audio-Video Communications

3.3 MANUFACTURER'S ASSISTANCE

- A. Qualified technical representatives of manufacturers shall be available to visit the project and provide required assistance for any problems or trouble areas of any systems, material or equipment used in the project. Manufacturer's engineering assistance shall also be available for above problems or trouble areas. The Contractor shall purchase all materials, equipment or systems with these services included in the purchase price or otherwise be prepared to have the above service provided when needed or requested by the Engineer without additional compensation. Where one manufacturer's equipment constitutes the majority of the components or devices to make a system, the manufacturer's technically qualified representative shall inspect and accept the completed installation whether or not especially requested by the Engineer.

3.4 INSTRUCTION AND TRAINING OF OWNER'S REPRESENTATIVE

- A. The Division 27 Trades shall instruct and train the representatives of the Owner in the proper operation and maintenance of all elements of the Electronic Communication Systems. Competent representatives of the Contractor shall spend one (1) week for each of the respective Division 27 systems, unless noted otherwise here in below. Competent representatives of the Contractor shall spend four (4) weeks for each of the respective systems: Data Communications, Intercommunications and Program Systems. The times and locations for instruction and training to the Owner's personnel shall be set by the Owner at times and locations determined by the Owner over a period once the systems are functional for instruction and training. The instruction and training shall be given to all personnel as deemed necessary by the Owner. The instruction and training shall prepare the Owner to fully operate and maintain all of the above systems.

3.5 CONSTRUCTION STATUS REPORT:

- A. Each item of discrepancies noted on Construction Status Report prepared by the Architect/Engineer shall be answered in detail in writing by the Contractor before payment can be recommended.

END OF SECTION

SECTION 270526
GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

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 WORK INCLUDED

- A. Equipment Grounding Conductor
- B. Grounding for Data and Telecommunications Systems

1.3 RELATED WORK

- A. Section 260526 – Grounding and Bonding for Electrical Systems

1.4 REFERENCES

- A. NFPA 70 (NEC), Article 250

1.5 DESCRIPTION

- A. An insulated equipment grounding conductor, color coded per section 26 05 53, and the NEC, shall be provided for each alternating current circuit without exception.

1.6 TESTS

- A. The equipment grounding conductor shall be tested for continuity and proper bonding to metallic equipment enclosures, outlet boxes, wiring devices and similar items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Data Room Ground Bus Bar: Refer to 26 05 26, 3.2, K.

PART 3: EXECUTION

3.1 INSTALLATION

A. Equipment Grounding Conductor:

1. Provide a separate insulated grounding conductor, color-coded as per Section 26 05 53, enclosed in the same raceway with the phase conductors for all alternating current circuits, even though not necessarily shown on the drawings.
2. The equipment grounding conductor shall be secured to the equipment enclosure at the source of power and at the apparatus being served by the alternating current supply.
3. The minimum size for the grounding conductor shall be as specified in Table 250.122 of NEC.

B. Data Room Ground Bus Bars:

1. Provide a separate insulated grounding conductor (#3/0 AWG) between the IDF bus bar and nearest ground electrode.
2. Provide a separate insulated grounding conductor (#6 AWG) between each rack or cabinet to the IDF ground bus bar using cut-washer, double hole/double crimp grounding lugs, nuts, bolts and washers. Cut or sand paint away from rack or cabinet area where grounding lug is attached. Do not connect more than one rack or cabinet to a single ground wire.
3. Provide a separate insulated grounding conductor (#6 AWG) between each piece of electronic equipment (contractor provided or Owner provided) located in each rack or cabinet to the respective rack or cabinet in each data closet using cut-washer, double hole/double crimp grounding lugs, nuts, bolts and washers. Cut or sand paint away rack or cabinet and equipment area where grounding lug is attached. Do not connect more than one piece of equipment to the rack or cabinet with a single ground wire.

END OF SECTION

SECTION 270528
PATHWAYS FOR COMMUNICATION SYSTEMS

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 WORK INCLUDED

- A. Empty conduit system for Communications Systems including telephone and data as indicated.

1.3 RELATED WORK

- A. Section 260100 – Basic Requirements for Electrical Systems
- B. Section 260526 – Grounding and Bonding for Electrical Systems
- C. Section 260533 – Raceway and Boxes for Electrical Systems
- D. Section 260553 – Identification for Electrical Systems
- E. Section 270500 – Common Work Results for Communications
- F. Section 270526 – Grounding and Bonding for Communications Systems
- G. Section 270553 – Identification for Communications Systems

1.4 GENERAL OPERATION AND DESCRIPTION

- A. General: The communications systems shall consist of a complete (partial) empty conduit system as indicated.
- B. The raceway for this system shall be furnished and installed by the Division 26 electrical contractor in accordance with all related specification sections in Division 26 and 27. The Communications System Trade shall coordinate the work with Division 26.

1.5 REFERENCES

- A. The complete installation, including additions and modifications, shall be in accordance with:
 - 1. National Electrical Code Article 800.
 - 2. Minimum standards of Electronics Industries Association (EIA).

PART 2 - PRODUCTS

2.1 SYSTEM MATERIALS

- A. Provide wall outlets of standard 4" square (double-gang) by 2-1/8" deep outlet boxes, unless indicated otherwise on drawings or in other Division 27 specifications, with 4"

square by 3/4" mud ring or tile wall cover as applicable for single gang device. Face of mud ring or tile wall cover shall be flush with finished wall surface.

- B. Provide equipment panels of 3/4" thick, FRT AC grade fire-retardant plywood of 4' x 8' size unless indicated otherwise on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The Contractor shall provide all conduit, junction boxes, and materials required for the installation of an empty conduit Communications System in accordance with the specifications and drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification.
- B. Wiring:
 - 1. Partial Conduit Raceway System: All wiring methods (conduit only) shall be in accordance with NFPA-70, Article 800, and all other codes specified herein. All wiring to be installed under another contract.
 - 2. Communications Raceway System: Provide empty raceway system for telephone, data, and other communication systems outlets with conduit, boxes, cabinets, etc., as shown. Outlets, raceways and plates as specified in Division 26. All conduit runs to have long sweep radius elbows; condulets not permitted. There shall be a maximum of two 90° bends between outlets. Any run over 100'-0" in length shall have a pull box where approved by the Communications System Trade. Provide fish wires as previously specified. Cabinets shall be flush or surface mounted as required.
 - 3. Provide all conduit raceway runs of size and quantity as indicated on drawings and as specified below. Provide a 1" conduit raceway from each low-voltage device junction box (double-gang with single-gang plaster ring) to be stubbed and bushed out above the nearest accessible ceiling. From this location provide J-Hooks or utilize cable tray to extend wiring to MDF or IDF rooms. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ells.
 - 4. Communications systems service plywood panels shall be unpainted class "A" fire rated 4'-0" X 8'-0" X 3/4" thick plywood panels mounted at location shown on drawings with long dimension vertically. All conduits terminating at service panels shall be bushed 0'-6" above floor or 7'-6" above floor. Securely mount equipment panels to wall, level and plumb. Mount plywood equipment panels at 4" AFF to bottom with 8' length vertically, unless noted otherwise.
 - 5. Provide a ground bar for each service panel as described in Section 26 05 26. Furnish and install #6 wire in 3/4" conduit from service plywood panel to nearest ground electrode for ground. Leave 6'-0" excess at panel and attach other end with ground clamp to cold water main. Bond this systems grounding electrode to the Section 26 05 26 building grounding electrode system per NEC 800.
 - 6. Follow all raceway requirements specified in Division 26.
 - 7. Label pull cords with outlet served.

8. Apply sealant around all exterior mounted telecom outlets to provide weatherproofing and pest control; refer to Division 7 for joint sealants.
 9. Outlet locations indicated are for estimating purposes only. Coordinate final location with Owner and other installations; refer all conflicts to the Architect for resolution.
 10. Install service raceways as indicated on drawings. At equipment panels, terminate service raceways with bushings at 0'-8" and 7-10" above finished floors.
 11. Refer to the electrical site plan for service entrance conduits into MDF.
 12. All communications systems conduits, boxes, etc., shall be grounded to the building grounding electrode system and properly bushed.
 13. Pathways from any outlet for low voltage wiring shall be the best way possible to allow for the installation of the data cabling or system cabling to be installed from the outlet in a room to the MDF or IDFs via conduits, conduit sleeves, cable hangers above accessible ceilings, conduit above inaccessible ceilings and ladder trays in the MDF and IDFs.
- C. All boxes, conduits, etc., shall be of proper size, as determined by the Communications System Trade and shall be clearly marked for easy identification.

3.2 FIELD QUALITY CONTROL

- A. The Contractor shall submit the following information to the Architect/Engineer. "As-built" conduit layout diagrams.

END OF SECTION

SECTION 270553
IDENTIFICATION FOR COMMUNICATION SYSTEMS

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 WORK INCLUDED

- A. Prepare and paint Division 27 equipment supports and miscellaneous materials located in Equipment Rooms, IDF's, MDF and other utility areas housing mechanical, electrical, and communication equipment.
- B. Identification of cabinets, racks, equipment and other system enclosures.

1.3 WORK NOT INCLUDED

- A. Painting of factory finished Division 27 Equipment such as Data Communications, Voice Communications, Audio-Video Communications, Building Intercommunications Systems, Clock Systems, etc.

1.4 RELATED WORK

- A. Section 260553 – Identification for Electrical Systems
- B. Section 270500 – Common Work Results for Communications
- C. Section 270528 – Pathways for Communications Systems
- D. Section 272000 – Data Communications
- E. Section 273000 – Voice Communications
- F. Section 274000 – Audio-Video Communications
- G. Section 280553 – Identification for Electronic Safety and Security Systems

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Except as otherwise specified, materials shall be the products of the following manufacturers:
 - 1. Sherwin-Williams
 - 2. Pratt and Lambert
 - 3. Pittsburgh Plate Glass (PPG)
 - 4. Benjamin Moore

2.2 MATERIALS

- A. Deliver all paints and materials to the project site in their original containers with all labels intact and legible at the time of use.
- B. All paints, coatings and primers applied inside the weatherproofing system and applied on site shall meet the VOC requirements of Green Seal Standard GS-11.
- C. All anti-corrosive and anti-rust paints, coatings and primers applied inside the weatherproofing system and applied on site shall meet the VOC requirements of Green Seal Standard GS-03.
- D. Sherwin-Williams Industrial Maintenance Coatings System 4000 products are listed below to establish color and a standard of quality.
 - 1. All Hangers and Supports: One coat Series 54 Gloss Black Alkyd Enamel.
 - 2. Factory Finished Equipment finishes shall be cleaned and properly touched up with equipment manufacturers touch-up paint unless finish is severely damaged or of unacceptable quality. In the latter case, the entire finish shall be restored in accordance with painted procedures herein specified.
- E. Paint for this project shall be pre-catalyzed epoxy paint.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The work shall be accomplished by qualified mechanics skilled in the painting trade. Painting of equipment and other materials shall not commence until all testing is complete and systems are ready for operation. Materials shall be evenly spread, and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coats.

3.2 PROTECTION OF WORK

- A. The painters shall protect all adjacent surfaces with drop covers during the process of painting. Upon completion, paint spots, if any, shall be removed from all surfaces not intended to be painted.

3.3 PREPARATION OF SURFACE

- A. Surfaces to be painted shall be completely dry before applying paint. Metal surfaces shall be cleaned with mineral spirits before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be chemically treated with crystalline zinc phosphate in strict accordance with the manufacturer's recommendations. Surfaces shall not be painted when the temperature is, or is likely to be, near the freezing point, nor when they are exposed to hot sun.

3.4 IDENTIFICATION OF PIPES AND EQUIPMENT

- A. After all painting is completed, operating and control parts of the equipment and systems such as cabinets, racks, telephone cabinets, and system cabinets shall be properly identified with laminated engraved plastic nameplates fastened with sheet metal screws, bolts or permanent adhesive. Pressure sensitive tape is not acceptable. Identification symbols or designations shall be the same as shown on the contract documents.
- B. Boxes; Concealed and Surface Mounted: Each enclosure shall be neatly identified by stencil marking, which shall indicate service contained, circuit numbers (or zone numbers). Stencil letters shall be upper case (Capital) not less than one (1) inch high and painted with Series 54 black gloss enamel.
- C. The Division 27 Systems shall have an engraved informational laminated nameplate with the installing trade's name, telephone number and address for the Owner to obtain preventive maintenance, service or parts. The nameplate shall include the job order number, shop number or other identification, which will identify the related equipment.
- D. If the above address and telephone number is a branch office, the main office or manufacturer's address and telephone number shall be included.

END OF SECTION

SECTION 271013
INFRASTRUCTURE FOR BUILDING COMMUNICATIONS CABLING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing and installation of an empty conduit system for the building telecommunications cabling system. The building telecommunications system includes, but is not limited to low-voltage communication systems.
- B. The work of this section includes, but is not limited to, providing empty pathway system made up of communication junction boxes, communication conduits, J-hooks, and wall sleeves.
- C. Refer to other Division 27 specifications for communication module frames, module jacks, faceplates, terminations, cables, and all head-end equipment including but not limited to racks, switches, routers, splitters, amplifiers, modulators, etc. required for a complete and operating communications system.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and Division 1 and Division 26 specification sections, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Division 26 sections for work including, but not limited to, electrical raceways, electrical boxes and fittings, electrical wiring devices, wallplates and cabinets required in conjunction with installation of the infrastructure for the telecommunications systems.

1.4 REFERENCES AND CODES

- A. 2020 NFPA-70--National Electrical Code
- B. ANSI/IEEE C-2--National Electrical Safety Code
- C. OSHA Standards and Regulations
- D. Pertinent Local Codes and Standards

1.5 COORDINATION

- A. Coordinate work of this section with requirements of the local telephone, data and/or cable television service providers.

PART 2 - PRODUCTS

2.1 SYSTEM MATERIALS

- A. Provide wall outlets of standard 4-11/16" square (double-gang) by 2-1/8" deep outlet boxes, unless indicated otherwise on drawings, with 4" square by 3/4" mud ring or tile wall cover as applicable for single gang device. Face of mud ring or tile wall cover shall be flush with finished wall surface.
- B. Wall plates will be provided by Division 27 contractor/installer.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Follow all raceway requirements specified in Division 26.
 - 2. Apply sealant around all exterior mounted telecom outlets to provide weatherproofing and pest control; refer to Division 7 for joint sealants.
 - 3. Provide all conduit raceway runs of size and quantity as indicated on drawings and as specified below. Provide empty conduit raceways with nylon pull cord. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ell.
 - 4. Label pull cords with outlet served.
 - 5. Outlet locations indicated are for estimating purposes only. Coordinate final location with other installations and with Owner or Owner's low-voltage contractor/installer and refer all conflicts to the Architect for resolution.
- B. Service: Provide new communication service from the demarcation location shown on the Electrical Site Plan to the new Lower Level IT Room in the new building. The contractor shall provide a pathway system made up of a combination of conduits, J-hooks, and wall sleeves from the new IT room on the Lower Level (MDF) to the IT rooms (IDF's) on the Main Level and the Upper Level.
- C. Communication Outlets: 1. The work shall also include pathways from each communication device to the new MDF and IDF rooms in the new building. This includes, but is not limited to, providing a combination of wall or ceiling mounted communication junction boxes with one 1" conduit from those boxes to extend up to accessible ceiling space of room in which the outlet is located, or to the area above the nearest accessible corridor ceiling. If an accessible ceiling is not available, extend the conduits to the new IDF. All conduits stubbed into accessible ceiling space or into IDF room shall be provided with bushings on the end of the conduits and shall be provided with pull cord in each conduit.

END OF SECTION

SECTION 272000
DATA COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Complete vertical and horizontal Communication/Data Network System as indicated.

1.3 RELATED WORK

- A. Division 26 – Electrical
- B. Section 27 30 00 – Voice Communications
- C. Section 27 40 00 – Audio-Video Communications
- D. Division 28 – Electronic Safety and Security

1.4 GENERAL OPERATION AND DESCRIPTION

- A. General: Furnish and install one (1) complete Communication/Data Network as described herein and as shown on the plans; to be wired, connected and left in first class operating condition. The network shall consist of data cabling for (Data Network, Outside Telephone, IP phone system, IP clock system, IP intercom, Interactive System and etc. These systems making up the Communication/Data Network will be structured with individual backbones and horizontal distributions from the Main Communications room (MDF) and emanate to each remote communication room (IDF) and/or data outlet. The Communication/Data network shall use Panduit Cabling components and General Cabling Systems for Connection devices, single mode Fiber Cables, Category 6 cable and components for the Communication/Data Network System and all other necessary materials for complete Cable plant and infrastructure. The contractor shall furnish all new networking as required and as called for. The Owner will provide and install all electronic components.

- B. Description:

1. Backbone Distribution:

- a. LAN: The backbone distribution cable for the LAN shall consist of one (1) 12 fiber single-mode cable homerun from each remote IDF Rack (on main and upper levels) to the main MDF Racks (on the lower level). Terminate all fibers on both ends with LC connectors in fiber trays as needed. Cables shall be rated for indoor and outdoor/underground use as required.
- b. Telephone: The backbone distribution cables for dedicated telephone lines shall consist of the required one twenty-five (25) pair LAN cables of 24

AWG solid copper conductors terminating on 110 blocks with legs from each IDF to the MDF.

2. Horizontal Distribution:

- a. LAN (Computers, IP Telephone, IP Clocks, IP Speakers, IP Cameras and etc.): The horizontal LAN cables shall be of Category 6, plenum rated and homeruns from station devices to the respective Rack or cabinet patch panels.
- b. Telephones, alarm circuit dialers: The horizontal telephone cables shall be Category 6, plenum rated and homeruns from station devices to the respective Comm rooms horizontal backbone cross-connect field 110 blocks with legs.

3. Patch panel cables and fiber optic jumpers.

- a. LAN Network Patch Panel Cables: Cables shall be Category 6, with Category 6 (RJ45) connectors on each end. Patch panel cables shall connect to rack mounted switches and rack mounted Category 6 patch panels.
- b. LAN Network Fiber Optic Jumpers: Fiber optic jumpers shall each be a single fiber with LC connectors on each end, as required, and terminate between the fiber tray and a panel in racks containing switches. Also, jumpers shall connect between rack mounted panel and switches. Coordinate required connectors with electronic devices. All ends shall be factory terminated.
- c. Classroom Outlet Jumper Cables: Cables shall be Category 6, with Category 6 (RJ45) connectors on each end. All ends shall be factory terminated.

4. LAN Racks and Station Termination Devices:

- a. LAN Racks or cabinet: LAN 4-post racks shall consist of enough Category 6 patch panels, cable organizers, hooks, optical patch panels and new switches. Racks shall be bolted to the floor, or thru-bolted to the wall, as indicated. Cabinet shall be braced to the structure and walls with angled metal braces.
- b. Station Termination Devices: Devices shall be multiple outlet devices, recessed mounted single gang with Category 6 (RJ45) jacks for voice and data with mounting kits required with double gang outlet boxes in walls as indicated.

5. Routing of Cable:

- a. Backbone Distribution: Cables shall utilize conduits, ladder tray and specified J-hooks. All cables shall be mounted and supported as necessary to ensure proper installation.
- b. Horizontal Distribution: Cables shall utilize conduits and hooks in station termination areas and, "hooks" and conduits in corridors. All conduits shall be properly grounded.

6. Ethernet Electronic Equipment:

- a. Cable support brackets
- b. Patch panels with Panduit Cat 6 Mini-Coms.
- c. Fiber Trays consisting of 24 couplers, with spools, ties, covers, etc.
- d. Stackable switches with Fiber Optic Ethernet media adapters, advanced management module are provided by the Owner.
- e. All necessary electronic equipment, software, and programming, Owner furnished.

7. Miscellaneous Termination Components:

- a. Cable support brackets
- b. Patch panels with Panduit Cat 6 Mini-Coms.
- c. Fiber Trays consisting of 24 couplers, with spools, ties, covers, etc.
- d. Wall mounted 110 termination, 50 pair patch panels.

C. Operation:

- 1. Use: Cable plant for the Data Network shall be such that the Owner can activate any LAN termination as indicated on drawings by connecting a computer to any station outlet.
- 2. Testing: All cables and jumpers shall be tested before installation and after installation. The testing of all cables shall conform to TIA/EIA and Industry Test Standards for Category 6 cables, connector and fiber optic cables. The entire cable plant shall be Panduit certified with a twenty-five (25) year Panduit Certification Plus with General cabling. Test result for all cables shall be recorded and turned over to the Owner and Engineer.
- 3. Labeling: All cable shall be labeled and recorded. A copy of this wiring table shall be turned over to the Owner and Engineer. The Owner's approved room designation shall be part of the cable identification number. See architectural sheets for exact room numbers. A copy of this wiring table shall be retained by the installing trade.
- 4. Riser Diagram: A complete riser diagram labeled with origination point, destination prints, room numbers, jack ID, port ID and cable ID shall be turned over to the Owner and Engineer. A copy of this riser diagram shall be retained by the installing trade.

1.5 QUALITY ASSURANCE

- A. Source Quality Control: Materials and equipment shall be new, unused, conform to present revisions TIA/EIA specifications and UL listed.
- B. The Communication/Data Network and components shall be installed by one (1) single Communication/Data Network Trade of established reputation and experience in Communication and data network installation and shall have installed similar systems for a period of at least ten (10) years (except 5 years for Category 6) and shall be able to refer to similar installations rendering satisfactory service. The Communication/Data Network Trade shall be Panduit and General certified.
- C. The Communication/Data Network Trade shall be qualified as stated hereinafter in the installation and testing of the System being provided and shall be completely versed in TIA/EIA standards and practices. The above Communication/Data Network Trade's authorized technical representative shall be hereinafter known as the "Comm/Data Trade". The Comm/Data Technician and his employer shall be capable of providing test reports containing the test data of all cables installed whether terminated or spared. The Comm/Data Technician shall install and test all components of the network not provided by the Owner, and provide wiring tables and certification to the Owner's representative and Engineer. The Comm/Data Network installation shall include cabling, connections, components, marking, testing, and certification. The Electrical Trade shall provide conduits, junction boxes and pull boxes as indicated or needed, and as required by the Comm/Data Trade's instructions. The Comm/Data Trade shall furnish all cabling, all racks, all patch panels, all connecting blocks, all couplers, all connectors, all terminating devices, all special boxes, and all accessories and parts associated with the above.
- D. The Comm/Data Trade shall have a Registered Communication Distribution Designer (RCDD) certified by BICSI.
- E. The Comm/Data Trade shall be certified Panduit and General reseller.
- F. The Comm/Data Trade shall be a familiar with Cisco Networks and equipment.
- G. The Comm/Data Trade shall also furnish a list of similar or equal installation (a minimum of 10) and shall have at least five (5) years of company experience in this type of work.
- H. The installing trade shall be with 150 miles of the construction site. Trade must be able to provide same day service calls.
- I. Contractor must have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
- J. Contractor must complete their own work/trade. The use of a subcontractor is discouraged.

- K. Contractor must be a corporate BICSI member and be able to provide documentation with the bid.
- L. Contractor must employ a minimum of fifteen full-time installers. At least 20 percent of the technicians on the job must have a current Panduit Certified Copper Technicians certificate.
- M. At least 20 percent of the technicians installing any Fiber Distribution Systems must have a current Panduit Certified Fiber Technicians certificate.
- N. The Telecommunications contractor must provide a project manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:
 - Initiate and coordinate tasks with the County's Project Manager and others as specified by the project schedule.
 - Provide day to day direction and-site supervision of Contractor personnel.
 - Ensure conformance with all contract and warranty provisions.
 - Participate in site project meetings.
 - This individual will remain project manager for the duration of the project. The contractor may change Project Manager only with the written approval of the County.

1.6 REFERENCES

- A. The complete installation, including additions and modifications, shall be in accordance with the following:
 - 1. National Electrical Code Article 800.
 - 2. TIA/EIA Standards to their latest revisions:
 - a. The 2018 Virginia Construction Code.
 - b. National Electrical Code Article 760.
 - c. Twisted Pair Cables - (TSB-36).
 - d. Applicable Connectors - (TSB-40).
 - e. Measurement of Fiber or Cable Lengths Using an (OTDR) - (TIA/EIA-455-60).
 - f. Measurement of Fiber or Cable Attenuation Using an (OTDR) - (TIA/EIA-455-61).
 - g. ANSI/TIA/EIA-455, Standard test procedures for Fiber Optic Fibers, Cables and Transducers, sensors, connecting and terminating devices, and other fiber optic components.
 - h. ANSI/TIA/EIA-598-A, Color Coding of Optical Fiber Cable.
 - i. ANSI/TIA/EIA-604-3, FOCIS 3 Fiber Optic Connector Intermateability Standard
 - j. ANSI Z136.2, American Standard for the Safe Operation of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources.
 - k. ANSI/ICEA S-80-576, Communications Wire and Cable for Wiring Premises

- l. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
- m. ANSI/ICEA S-84-608, Filled Telecommunications Cable
- n. ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Cabling Standard
- o. ANSI/TIA/EIA-568-A-1, Standard, Propagation Delay and Delay Skew Specifications for 100 Ω 4-pair cable
- p. ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A
- q. ANSI/TIA/568-A-5, Additional Transmission Performance Specifications for 4-pair 100 Ω Enhanced Category 6 cabling.
- r. ANSI/TIA/EIA-569-A, Standard, Commercial Building Standard for Telecommunications Pathways and Spaces
- s. ANSI/TIA/EIA-569-A-1, Perimeter Pathways Addendum
- t. ANSI/TIA/EIA-570-a, Standard Residential Telecommunication Cabling Standard (proposed revision to 570)
- u. ANSI/TIA/EIA-607, Commercial Buildings Grounding and Bonding Requirements for Telecommunications.
- v. ANSI/TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard (proposed new standard)
- w. ANSI/TIA/EIA-758-1, Customer-Owned Outside Plant Telecommunications Cabling Standard (proposed revision to 758)
- x. TSB67, Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
- y. TSB72, Centralized Optical Fiber Cabling Guidelines
- z. TSB75, Additional Horizontal Cabling Practices for Open Offices.
- aa. TBS95, Additional Transmission Performance Guidelines for 100 Ω 4-pair Category 6 cabling
- bb. ISO/IEC 11801, Information Technology – Generic cabling for customer premises
- cc. IEC 1000 5-2, Grounding and Bonding
- dd. ASTM D 4565 – 90, Physical and Environmental Properties of Insulation and Jackets for Telecommunications Wire and Cable (see B1.7)
- ee. ASTM D 4566-90, Electrical Performance Properties of Insulation's and Jackets for Telecommunications Wire and Cable.
- ff. ASTM E 814, Fire Test of Through Fire Stops
- gg. ANSI/TIA/EIA 568 B2.1 Transmission Performance Specifications for 4-Pair 100 Ohm Enhanced Category 6 Cabling (latest revision).
- hh. ANSI/TIA-526-7-A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
- ii. ANSI/TIA-526-14-C Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
- jj. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises.
- kk. ANSI/TIA-568-C.2 Balance Twisted Pair Communications and Components Standards.
- ll. ANSI/TIA-568-C.2-2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing.
- mm. ANSI/TIA-569-D Telecommunications Pathways and Spaces.
- nn. ANSI/TIA-598-D Optical Fiber Cable Color Coding.

- oo. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure.
- pp. ANSI/TIA-606-B-1 Administration Standard for Telecommunications Infrastructure Addendum 1- Automated Infrastructure Management Systems - Addendum to ANSI/TIA-606-B.
- qq. ANSI/TIA-607-C Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- rr. ANSI/TIA-758-B Customer-Owned Outside Plant Telecommunication Infrastructure Standard.
- ss. ANSI/TIA-862-A Building Automation Systems Cabling Standard.
- tt. ANSI/TIA-1183-1 Measurement Methods and Test Fixtures for Balun-Less.
- uu. Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183.
- vv. ANSI/TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling.
- ww. ANSI/TIA-1183 Measurement Methods and Test Fixtures for Balun- Less Measurements of Balanced Components and Systems.
- xx. ANSI/TIA-4966 Telecommunications Infrastructure Standard for Educational Facilities.
- yy. TIA-TSB-155-A Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T.
- zz. TIA-TSB-184 Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling.
- aaa. TIA-TSB-162-A Telecommunications Cabling Guidelines for Wireless Access Points.
- bbb. TIA-568-C.3 Optical Fiber Cabling Components Standard.
- ccc. TIA-568-C.3-1 Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors.
- ddd. ISO/IEC 14763-2 Edition 1.0: Implementation and Operation of Customer Premises Cabling – Part 2: Planning and Installation.
- eee. ISO/IEC 14763-3 Edition 2 – Testing of Optical Fiber Cabling – methods for inspection and testing of installed optical fiber.
- fff. ISO/IEC TR 29125: Information technology -- Telecommunications cabling requirements for remote powering of terminal equipment.
- ggg. ANSI/BICSI 005, Electronic Safety and Security (ESS) System Design and Implementation Best Practices.
- hhh. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition.
- iii. Network Systems and Commissioning (NSC) reference, 1st Edition.
- jjj. ANSI/NECA/BICSI 568, Standard for Installing Commercial Building Telecommunications Cabling.
- kkk. NECA/BICSI 607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
- lll. ANSI/BICSI 001, Information Transport Systems Design Standard for K-12 Educational Institutions.
- mmm. BICSI-003-2014 Building Information Modeling (BIM) Practices for Information Technology Systems.
- nnn. Telecommunications Distribution Methods Manual, 13th Edition.
- ooo. AV Design Reference Manual, 1st Edition.

- ppp. Network Design Reference Manual, 7th Edition.
- qqq. Outside Plant Design Reference Manual, 5th Edition.
- rrr. Wireless Design Reference Manual, 3rd Edition.
- sss. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- ttt. Commercial Installation On-the-Job Training Booklet.
- uuu. Telecommunications Project Management (TPM) reference, 1st Edition.

1.7 SUBMITTALS

- A. Submit shop drawing and product data in accordance with Section 27 05 00.
 - 1. Shop Drawings: The Comm/Data Trade shall provide engineering data sheets on each component and complete servicing data including part numbers of the various components.
 - 2. Product Data: Submit application, technical and installation data.
- B. Submit wiring table and test data in accordance with Section 27 05 00.
- C. Submit Operation and Maintenance Manuals in accordance with Section 27 05 00.
- D. Submit a complete one-line riser diagram showing all equipment, cable and outlets identified with room numbers, part numbers and cable ID. Room numbers shall be included in the cable I.D. The room numbers shall be the final Owner approved room numbers. Confirm with owner that the final Owner approved room numbers are the room numbers on the Architectural drawings without the "Area" designator.

1.8 WARRANTY, SERVICES

- A. The Comm/Data Trade shall provide a Panduit Certification Plus System Warranty for this Network, minus electronic components, for a minimum of twenty-five (25) years from date of acceptance by Owner and shall provide parts and labor to fulfill this warranty at no cost to the Owner. The electronic components shall be warranted. Upon acceptance of Warranty, Panduit will mail a notification letter to the installer and a notification letter and warranty certificate to the County.
- B. Refer to Division 1 for submission of warranty.
- C. Qualified service and parts shall be available to call on within a 100 mile basis.
- D. Service personnel shall respond within 72 hours (maximum) to all trouble calls.

1.9 SUBSTITUTIONS

- A. Substitutions shall not be allowed on the data products listed due to the current standards and materials used in the County.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The backbone riser fiber optic distribution cable and end to end terminations (Plenum rated) shall be based on General OS2 low water peak single mode fiber. (No Substitution).
- B. The horizontal copper distribution cables (plenum rated) for the LAN shall be based on General Category 6 and 6A CMP cabling for station drops and access points. (No Substitution).
- C. The wire management/equipment cabinets with associated components shall be based on Panduit products whose numbers are used herein. (No Substitution).
- D. The multiple port station outlets, patch panels and wire management devices shall be based on Panduit products whose numbers are used herein. (No Substitution).
- E. All system copper wiring shall be furnished by a single manufacturer. All system wiring and termination components shall be furnished by a single manufacturer. All system fiber optic cabling shall be furnished by a single manufacturer.
- F. All system electronic data switches shall be furnished by the Owner.
- G. Panduit and General Cable are the only accepted partnerships or single source manufactures allowed for the copper cables, fiber optic cables and connectively components in this Specification Section.
- H. UPSs shall be by APC or acceptable equal.

2.2 SYSTEM COMPONENTS

- A. Cables for Data Network: Plenum rated:
 - 1. Backbone and WAN Distribution:
 - a. LAN Distribution Cable: 12 fiber OS2 distribution cable, single-mode, buffered fibers, 8.0 um core, 125 um cladding – General Cable Product Code #FSPP912Y. Color of cable shall be yellow. All fiber optic glass shall be Corning. All cable fiber optic cables shall be inside an armored jacket (like Greenfield). All cables shall be plenum rated. The above fiber cables are required to be pulled through 2" EMT conduit above hard or gyp board ceilings and in 4" PVC when pulled through under floor conduits between rooms for support and protection against damage. Verify the proper cable number for indoor/outdoor plenum rated cable for use in floor slab on grade and provide as needed for use.
 - b. WAN Fiber shall be 12 fiber OS2, single mode by General Cable as noted above except configured (constructed) for outside, underground, water blocking, zero water peak and rated for indoor and outdoor use.

- c. Telephone Distribution Cable: 25 pair distribution cable, 24 AWG solid-copper conductors insulated color-coded PVC. General Cable Product Code #2131550E (CMP/MPP).
 2. Horizontal Distribution: LAN: (Data, Voice, Clock, Speakers and Voice) Four (4) twisted-pair and meet all TIA/EIA Category 6 specifications. ITC approved cable. General Cable LAN Cable No. 7131800BU, Cat 6 CMP-LP rated copper, 23 AWG, blue cable color. (WAP) Four (4) twisted-pair and meet all TIA/EIA Category 6A specifications. ITC approved cable. General Cable LAN Cable No. PUP6AM04XX-UGGR or 7131829, Cat 6A CMP rated copper, 23 AWG, green cable color All horizontal Distribution LAN cable used in or under the floor slab on grade shall be indoor/outdoor plenum rated. Verify the proper cable number for indoor/outdoor plenum rated cable for use in floor slab on grade and provide as needed for use. Cable must be reel tested at 600 MHz from the factory. Each reel of cable shall have a factory test report to present to the Owner.
 3. Patch Panel Cables, Fiber Optic Jumper:
 - a. Patch Panel Cables: Four (4) twisted-pair with RJ-45 connectors on both ends and meet all TIA/EIA Category 6 or 6A specifications. Patch cable shall be ITC approved cable, Panduit PN#UTP28SSP10BU series with lengths as required. Keep jumpers as short as possible.
 - b. Fiber Optic Jumpers: Two (2) fiber optic conductors, factory terminated to desired lengths as needed. Dual fiber cable single mode, buffered, 8.0 μm Core, 125 μm cladding with LC single mode connections – Panduit Product Code #F91BN1NNNSNM001 for single mode fiber optic jumpers. See riser diagram for quantities.
- B. 4 Post Rack LAN Termination Devices:
1. Multiple 24 port stack panel fiber trays Panduit Product Code #FST24H3: Cabinet mounted for LC connection of single mode fiber complete with the following:
 - a. Fiber Organizer Spools.
 - b. Tray Cover, cable restraints and miscellaneous hardware.
 - c. Couplers: For LC type single-mode fiber optic connectors.
 2. Fiber Optic Connectors: LC single mode connector plugs - for terminating both ends of all fiber optic distribution cables.
 3. Consumable Kits: Enough supplies per kit to terminate a minimum of 300 LC single mode connectors.
 4. Couplers: For LC type for single mode fiber optic connectors.
 5. Racks:
 - a. Racks: Shall be as listed below.
 - b. Port Patch Panels: Cat 6 Mini-Com jacks. Panduit 48 port 2U Cpp48FMWBL series with copper modules and required accessories

- (distribution modules, front and rear retainer, fasteners, labels, icons, etc.) provide mini con jacks in patch panels.
 - c. Horizontal cable management shall be required. Panduit NMF2 series with cover.
 - d. Vertical Cable Management: Panduit WMPVF series with cover to run from top to bottom.
6. LAN Racks: Panduit RP4 4 post rack (84"H x 20.3"W x 30"D). Rack shall be bolted to the floor and have angled wall bracing. Provide 3 shelves for each rack for equipment.
- C. Data Communications (Room or Closet) Telephone Termination Devices: SYSTIMAX 110 Block Equipment.
- 1. 110 Wiring Blocks: 50 Pair Capacity. Panduit #110-50 series.
 - 2. 110-C Connecting Blocks: 4 pair capacity. Panduit #110C series.
 - 3. Cable trough between 110 blocks for cable support.
 - 4. Cross connect cables.
 - 5. Provide quantities as needed.
- D. Station Termination Devices:
- 1. Single gang Cat 6 multiport, as required, 100 style Keystone Jack Faceplate – Panduit Mini-Com Cat 6 multiport, as required, Series #CFPE6WHY (Ivory).
 - 2. Category 6A (RJ45) Jack (voice and data) – Panduit #CJ6X88tGIEI (Ivory).
 - 3. Blank Inserts – Panduit #CHB2EI (Ivory).
 - 4. Computer Icon - Panduit #CIDGR – (Green).
 - 5. Telephone Icon - Panduit #CIDGR - (Green) (Intercom and Telephone).
 - 6. Wireless Icon - Panduit #CIDOR – (Orange)
- E. Ethernet Electronic Equipment: See drawings for Rack Layouts. All electronic switching equipment shall be Owner provided.
- F. Rack power strips shall be horizontal (Tripp-Lite RS-1215) and vertical cabinet (Tripp-Lite vertical single phase switched PDUs, 20 amp, 24 NEMA 5-15/20 receptacles, visual current meters, Ethernet interface for reporting power and load characteristic). Power Strips are as indicated on the Drawings. Provide temperature sensor with each PDU.
- G. Rack mounted UPS Units:
- 1. One (1) APC SMT2200RM2U WITH SMART CARD, Smart-UPS Modular 2200VA 120V per rack. This UPS shall be utilized in all data network racks unless noted otherwise.
 - 2. One (1) APC AP9631, UPS Network Mgmt Card 2 w/ Environmental Monitoring, one per each ups.
 - 3. One (1) NEMA 5-20R receptacle 120V, one per rack. Refer to enlarged IDF enlarged plans on Electrical drawings for installation requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Comm/Data Trade shall be responsible for all arrangements for testing, recording and certification of the Comm/Data Network cabling to meet all applicable and current TIA/EIA standards before the Comm/Data Network is accepted by the Owner and the Engineer.
- B. The Owner retains the right to conduct inspections of the Comm/Data Trade's work at the Owner's discretion. For record purposes the Owner is requested to submit their observations in writing to the Engineer. Upon completion of all testing and acceptance is given by the Owner and the Engineer, all inspection reports shall be given to the Owner.

3.2 INSTALLATION

- A. General: The Comm/Data Trade shall provide all new equipment, accessories and material required for the installation of the Comm/Data Network in accordance with the specifications and drawings. Any material and/or equipment necessary for the proper operation of the system that is not specified or described herein shall be deemed part of this specification.
- B. Wiring:
 - 1. Complete Conduit, Ladder Tray, Raceway and J-Hook System: Provide proper number and size of conductors as required for connection of the data network components in accordance with the manufacturer's instructions. All wiring methods shall be in accordance with NEC 800, and applicable TIA/EIA specifications.
 - 2. No wiring other than that directly associated with the Comm/Data network shall be permitted in data conduits, raceways, cable tray and hooks. Provide cable separation for other low voltage cable systems in the cable and ladder trays.
 - 3. Conductor splices are not permitted.
 - 4. Transposing or changing color coding of wires shall not be permitted.
 - 5. All conductors shall be labeled on each end with "E-Z markers" or equivalent.
 - 6. The labels on both ends of the conductors shall be marked in accordance with TIA/EIA standards. Cable identifiers shall also be located in each wall jack and the respective patch panel jack.
 - 7. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its termination. All cable bends shall conform to TIA/EIA standards.
 - 8. All equipment shall be numbered.
 - 9. Each riser cables shall be secured as it is broken out and/or passes through cabinet, for support.
 - 10. All wiring shall be checked and tested to insure their integrity and performance in accordance with all applicable TIA/EIA specifications to their latest revisions before installation and after installation.

11. The labels on both ends of the conductors and jack plates shall be marked in a fashion such as "**Room Number*-*Jack Number*", such as "138-1". "138" is the room number in which the conductor terminates. "1" is the port number in the associated rack. The Owner shall review this labeling scheme and shall modify as desired during the shop drawing phase. Owner shall sign off on final labeling.
 12. Provide 5' of slack cabling at the station junction for each data cable. Provide 10' of slack cabling in the MDF or IDF for all data cabling.
 13. See are references above.
- C. All boxes, conduits, etc., shall be of proper size, as determined by the Comm/Data Trade, shall be clearly marked for easy identification, continuously grounded together and bonded to the building grounding electrode system via the MDF or IDF ground bars. The Comm/Data Trade shall furnish special boxes to the Electrical Trade for installation by the Electrical Trade.
- D. All power cables must maintain their minimum clearances from the Comm/Data network cables per TIA/EIA Standards.

Separation and Physical Protection for Station and Distribution Wire:

Voltage Source	Type of Wire Involved	Separation
Electrical Supply	Bare wire (any voltage, or open wire over 300 V 5 ft.	
	Open wire not over 300 V	12 in.
	Wiring not over 120V	12 in.
	Wiring not over 277V	40 in.
Radio & Television	Antenna lead-in or ground wire	4 in.
Signal or Control	All types	None
Telecommunications	Drop Wire, all types	2 in.

Separation of Telecommunications Pathways from </-480V Power Lines:

Condition	Minimum Distance		
	<2 kVA	2-5 kVA	>5 kVA
Unshielded power lines or electrical equipment in proximity to open nonmetal pathways	127mm 610mm (5 in)	305mm (12 in)	(24 in)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway	64mm 305mm (2.5 in)	152mm (6 in)	(12 in)
Power lines enclosed in a grounded metal conduit	----- 152mm	76mm	

(or equivalent shielding) in proximity to a grounded metal pathway ----- (3 in) (6 in)

- E. The complete wiring for the Comm/Data network is not shown on the drawings. The actual conductor routing of the Comm/Data network shall be by the Comm/Data Trade based on the location of the devices, conductor limitations and cable limitations.
- F. Each recessed new Comm/Data and Telephone outlet located in walls shall consist of a 4" x 4" x 2.125 deep outlet box with a double gang adapter plate (4"x4"). The depth of the adapter's offset shall depend on the wall construction encountered. Provide a 1" conduit raceway from each low-voltage device junction box (double-gang with single-gang plaster ring) to be stubbed and bushed out above the nearest accessible ceiling. From this location provide J-Hooks or utilize cable tray to extend wiring to MDF or IDF rooms. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ell.
- G. Color coding at administration panels to identify the distribution fields should be as follows as a minimum:
 - 1. Blue: Work Location and Horizontal cables
 - 2. White: Backbone and campus cables
 - 3. Purple: Common equipment
 - 4. Green: Incoming Telco trunks
 - 5. Yellow: Single-mode Fibers
 - 6. Gray: Tie Cable
- H. Backbone Distribution:
 - 1. LAN: The backbone distribution cables for the LAN shall consist of one (1) 12 fiber optic cables (single mode) homerun from the existing rack in the MDF to the IDF. These fibers shall create a star topology. Terminate all fibers on both ends with LC connectors and secure to couplers in suitable cabinet mounted fiber tray. Cables shall be properly supported. Cables shall be properly secured to cabinets. All fiber cables shall be in armor jack. These cables shall be pulled through conduit above hard ceilings without access and under floor on grade. These cables shall be indoor/outdoor plenum rated when used underground or under/in floor slab on grade.
 - 2. Dedicated Telephone Lines: The backbone cables shall consist of the following:
 - a. IDF room:
 - (1) A minimum of twenty-five (25) pair backbone cables shall run to between MDF and 110 blocks in the IDF with dedicated data wiring interconnecting line to various cabinet patch panels as indicated in the data backbone riser diagram.
 - (2) Provide solid state surge suppression on all exterior copper cables entering any building mentioned above.

- b. The specified cables are CMR/MPR rated and require metal conduits in plenum applications.
 - c. Cross/Connect Fields:
 - (1) Cables shall be terminated on both ends to 100 pair capacity "110" blocks with legs in respective rooms.
 - (2) Provide cross/connect cables and cable troughs.
 - d. Cables shall be properly secured to Class A fire rate plywood panels in the IDF Room.
3. Testing: All cables shall be tested before and after installation to TIA/EIA Standards and those mentioned herein to ensure the integrity and performance of each conductor.
- I. Horizontal Distribution:
- 1. LAN: The horizontal LAN cables for systems shall be Category 6 or 6A, plenum rated and homeruns from station devices and WAP to respective rack's or rack's patch panels. Cables shall attach to patch panels via Panduit Mini-Com devices. Cables shall terminate to (RJ45) Category 6 jacks on station ends via Panduit Mini-Com devices. Cable shall utilize conduits, raceways, or hanger or ladder tray as required.
 - 2. Dedicated Telephone Lines: The horizontal telephone cables shall be Category 6, plenum rated and homeruns from station devices to respective racks. Cables shall utilize hangers, conduits and ladder trays in closets and corridors. Cables shall utilize conduits and/or raceways in areas with station devices. Cables shall terminate to RJ11-110 style jacks at the station end. Cables shall utilize ladder tray in closets and conduits and handers in corridors. Cables shall utilize conduit and/or raceways in area with station devices. Cables shall be support on 48" centers.
 - 3. Testing: All cables shall be tested before and after installation to TIA/EIA Standards and those mentioned herein to ensure the integrity and performance of each conductor to Category 6 levels. Cable must be reel tested at 600 MHz from the factory. Each reel of cable shall have a factory test report to present to the Owner.
- J. Patch Panel Cables and Fiber Optic Jumpers:
- 1. Patch Panel Cables: The patch panel cables are factory assembled. The cable shall be Category 6 with Category 6 (RJ45) connectors on both ends. There shall be as many patch cables as there are connections to the patch panels from station devices. Patch panel cables shall connect from the patch panel to the switches as directed by the Owner (port assignments). Lengths shall be as short as possible and required. Train all cables neatly and cleanly.
 - 2. Fiber Optic Jumpers: The LAN network fiber optic jumpers shall each be a dual fibers with LC connectors on ends and terminate between respective cabinet mounted fiber trays and switches as directed by the Owner (port assignments).

The jumpers are factory assembled. Provide fiber optic jumpers to pair up with all terminated fibers in each cabinet.

3. Testing: Patch panel cables shall meet or exceed requirements in TIA/EIA Standard and those mentioned herein.

K. LAN Racks: Refer to drawings for layouts and schedule of equipment.

L. Station Termination Devices: Devices shall be multiple outlet devices, single gang with Category 6 (RJ45) jacks for voice and data as indicated by the symbols on the drawings.

M. Grounding: All cabinets, Owner's electronics, all metal parts in each cabinet, surface raceways, cable tray, conduit and conduit devices shall be grounded as a continuous system and connected to the building grounding electrode system per NFPA-70.

N. All racks shall be bolted to the floor and support from the wall with bracing.

3.3 TECHNICAL ASSISTANCE

A. Instruction: The Comm/Data Network Technician shall instruct the Owner's proper designated authority on the overall cable plant, devices, wiring tables and test data after the installation is completed.

3.4 FIELD QUALITY CONTROL

A. General: Upon completion of the installation, the Comm/Data Trade shall have performed all necessary TIA/EIA specified tests to the latest published revisions of the TIA/EIA standards and corrected any problems found during testing. The above representative shall then submit all documents and a letter of certification certifying test data required herein to the Owner and Engineer that the system functions and conforms to all requirements of the manufacturer of the equipment, the Contract Documents and all requirements of the latest revisions of the TIA/EIA standards.

B. The Comm/Data Trade shall perform all electrical tests required by present revisions of TIA/EIA specifications to ensure that all components of the Comm/Data network shall meet and exceed the following:

1. All Category 6 or 6A cables shall conform to or exceed the TIA/EIA 568 Rev. C, Commercial Building Wiring Standard, Horizontal Cable Section and the TIA/EIA Technical Systems Bulletin 36 for Unshielded Twisted Pair Cables. Other standards supported include IEEE 802.3, 1BASE5, 10BASE-T; IEEE 802.5, 4Mbps, 16Mbps (328 ft [100m], 104 Workstations) and proposed ANSI X3T9.5 TP-PMD requirements for UTP at 1000 Mbps. In addition, cables shall be capable of supporting evolving high-end applications such as 155 Mbps ATM, 622 Mbps at 100 MHz, and 1Gbps. Cable must be reel tested at 600 MHz from the factory. Each reel of cable shall have a factory test report to present to the Owner. Cat 6A shall be tested to 10Gbps
2. Category 6 & 6A: All plenum Category 6 and 6A Unshielded Twisted Pair (UTP) cables shall be composed of 23 AWG bare solid-copper conductors, insulated

- with TEFLON. The insulated conductors are twisted into pairs and sheathed with a low smoke PVC jacket and shall meet or exceed the Manufacturer's Electrical Specifications.
3. All Category 6 & 6A outlets shall utilize crossover lead technology to address data circuit applications up to 600 MHz and meet or exceed the Manufacturer's electrical, mechanical and NEXT specifications.
 4. Outlets shall be wired in an TIA/EIA 568C configuration.
 5. Category 6: All Category 6 cordage shall be round, 23 gauge tinned copper, stranded conductors insulated with solid polyolefin, tightly twisted into individual pairs and jacketed with flame retardant PVC and shall meet or exceed the Manufacturer's Electrical Specifications and the Worst Pair to Pair Near-End Crosstalk (NEXT) values.
 6. The fiber patch cord shall meet the following specifications:
 - a. Minimum bend radius: 1.00 inch (2.54 cm)
 - b. Operating temperature: -4 to 158°F (-20 to 70°C)
 - c. Loss: 0.4 Db/mated connector
 7. All Category 6 patch panels shall support 100 Mbps, 1000 Mbps, TP-PMD and 155 Mbps ATM and shall meet or exceed the Manufacturer's NEXT Values.
 8. The fiber cable shall meet the NEC requirements for OFNR or OFNP and comply with Bellcore, FDDI, TIA/EIA-568 and ICEA standards.
 9. The fiber cable shall meet the following specifications:
 - a. Fiber Dimensions:
 - (1) 8.0µm - core
 - (2) 125µm – cladding
 - b. Cable Minimum Bending Radius:
 - (1) During Installation: 20 times cable diameter
 - (2) After Installation: 10 times cable diameter
 - c. Buffered Fiber Minimum Bend Radius: .75 in. (1.91 cm)
 - d. Operating Temperature Range: 32°F to 122°F (0°C to 50°C)
 - e. Storage Temperature Range: -40°F to 149°F (-40°C to 65°C)
 10. Optical Specifications:
 - a. Maximum Fiber Loss: 3.5 dB/km at 850 nm (typical range 3.0 to 3.5 dB/km)
 - b. Maximum Fiber Loss: 1.5 dB/km at 1300 nm (typical range 0.5 to 0.8 dB/km)
 11. Minimum Bandwidth: 500 MHZ at 850 nm or higher; 500 MHZ at 1300 nm or higher
 12. LC connectors shall meet or exceed the following specifications:

- a. Operating Temperature: -40 to 185°F (-40 to 85°C)
 - b. Average Loss: 0.3 dB
- C. After completion of installation and testing, the Comm/Data Trade shall submit the following information to the Owner's authorized representative, and the Engineer.
 - 1. Cross Connection Documentation: Provide cross connect records for all data devices, and all racks.
 - 2. Wiring table of all conductors whether active or spare.
 - 3. Labeling of all components.
 - 4. Riser Diagram completely labeled.
 - 5. Floor plan layout of all outlets, cable pathways, cable trunks and equipment.
 - 6. Provide data cabling IDs on the floor plans by outlets and by patch panels in cabinet elevations.
- D. Documentation shall be submitted in the following format:
 - 1. Two (2) copies of all cross connect documentation in computerized form.
 - 2. Two (2) copies of all wiring tables in computerized form.
 - 3. Two (2) copies of all component labeling forms in computerized form.
 - 4. Two (2) copies of the riser diagrams and elevations.
 - 5. Two (2) copies of the test data in electronic form and paper form. Provide viewing software for the test data in electronic form or store the electric form in a format viewable by a word processor or standard browser.
 - 6. Provide C size set of laminated drawings of the data network riser, IDs of all cables, IDs of all outlets, provide outlet counts by cabinet and by room, provide IDs of all outlets in the building shown on a floor of the building broken up by the sections as indicated on the Contract Documents.
 - 7. Provide one (1) master book with all of the documents above.
- E. Upon completion of the project, Comm/Data Trade shall prepare "As Built" documentation showing actual installation as constructed.
- F. Two (2) days of eight hour each day for training shall be provided to the Owner at times and locations that suit the Owner's requirements. All documents, aids, instructions shall be provided by the Contractor. AV Record training and provide recording to Owner.
- G. In addition to the Data Trades diagrams, the following items shall be provided by the Comm/Data Trade:
 - 1. Test data conducted on all conductors and certification that the data is true and accurate.
 - 2. Provide all warranty and certification data to the Owner.

END OF SECTION

SECTION 273000
VOICE COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Partial raceway system for Telephone System as indicated (For wiring, cabling, jacks and terminating refer to Section 27 20 00 Data Communications).
- B. The Owner shall provide the electronics and VoIP phones. Contractor shall provide conduit, boxes, wiring and power.

1.3 RELATED WORK

- A. Division 26 – Electrical
- B. Section 270553 – Identification for Communications Systems
- C. Section 272000 – Data Communications

1.4 GENERAL OPERATION AND DESCRIPTION

- A. General: The telephone system shall consist of a partial empty conduit system.

1.5 REFERENCES

- A. The complete installation, including additions and modifications, shall be in accordance with:
 - 1. National Electrical Code Article 760 & 800.
 - 2. Minimum standards of Electronics Industries Association (EIA).

1.6 SUBMITTALS

- A. Submit shop drawings, a copy of the factory training certification and product data in accordance with Section 27 05 00.
 - 1. Product Data: Submit application, technical, and installation data with a one-line riser diagram of the entire system showing phone outlet locations, etc.
 - 2. Factory Training Certification: Submit copies of certification and updating for employer and employees of the System Trade.

- B. Submit Operation and Maintenance Manuals in accordance with Section 27 05 00.

1.7 WARRANTY, SERVICES

- A. The installer of the backbone cabling system for the phone system shall warrant this system wiring for a minimum of twenty-five (25) year from date of acceptance by Owner against defective parts and/or workmanship and shall provide parts and labor to fulfill this warranty at no cost to Owner. This warranty shall not apply if damage is caused by abuse, accident, improper operation or negligence.
- B. Refer to Section 27 05 00 for submission of warranty.
- C. Qualified service and parts shall be available to call on within a 50 mile basis.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. LAN for connections to Owner provided phone systems, including data outlets connectors, cables, jumpers, covers and patch panel shall be as specified in Section 27 20 00 Data Communications.
- B. The multiple port station outlets, patch panels and wire management devices shall be as specified in Section 27 20 00 Data Communications.
- C. It is recommended that the successful bidder of the section acquire the services of the successful bidder of Section 272000 for providing and installing data cabling, all data cabling terminations, testing, jacks, faceplates and jumpers. This is in efforts to keep the data cabling and respective data components as one uniform system supplied from one manufacturer across Division 27 and 28 Sections. The successful bidder of this section is still responsible for all components of this section.
- D. Owner furnished phones shall be PoE type.

2.2 SYSTEM COMPONENTS [S] [O/M]

- A. Cables for Data Network: (Plenum rated cables).
 - 1. Horizontal Distribution: LAN: (Voice) Four (4) twisted-pair and meet all TIA/EIA Category 6 specifications as indicated in Section 27 20 00 Data Communications. The cable shall be plenum rated inside and outdoor rated outside.
 - 2. Patch Panel Cables Jumpers:
 - a. Patch Panel Cables: Four (4) twisted-pair with RJ-45 connectors on both ends and meet all TIA/EIA Category 6 specifications indicated in Section 27 20 00 Data Communications.

- b. Jumper Cables: Four (4) twisted-pair with RJ-45 connectors on both ends and meet all TIA/EIA Category 6 specifications indicated in Section 27 20 00 Data Communications. Coordinate exact lengths in the field.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The system Trade shall provide all conduits, junction boxes, and materials required for the installation of a conduit system, conduit sleeves, cables, jumpers, surge suppression, enclosures, converters, receptacles and etc., in accordance with the specifications and drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification.
- B. Wiring:
 - 1. Conduit, Raceway, conduit sleeves, cable tray and J-Hook System: Provide proper number and size of conduits, boxes and hangers as required for cable pathway. All wiring methods shall be in accordance with NEC 800, and applicable TIA/EIA specifications.
 - 2. Communication System Raceways: Provide raceway system for electronic system with conduit system, conduit sleeves, cables, jumpers, surge suppression, enclosures, converters, receptacles and etc., as shown. Outlets, raceways and plates as specified elsewhere herein. All conduit runs to have long sweep radius elbows; condulets not permitted. There shall be a maximum of two 90° bends between outlets. Provide fish wires as previously specified.
 - 3. Furnish and install a 1" conduit raceway from each low-voltage device junction box (double-gang with single-gang plaster ring) to be stubbed and bushed out above the nearest accessible ceiling. From this location provide J-Hooks or utilize cable tray to extend wiring to MDF or IDF rooms. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ells.
 - 4. Conduit sleeve shall be installed in interior and exterior walls as needed and indicated on the door elevation detail.
 - 5. All outlet boxes for system shall be recessed and be 4"X4"X2.125" with single gang reducing ring or as needed by the installing trade.
 - 6. All system conduits, boxes, etc., shall be grounded to the building grounding electrode system via the MDF and IDF ground bars and properly bushed.
 - 7. Label the start and end of all system conduits with orange bands.
 - 8. No wiring other than that directly associated with the system shall be permitted in these conduits or open areas.
 - 9. Wiring splices are not allowed.
 - 10. Transposing or changing color coding of wires shall not be permitted.
 - 11. All conductors shall be labeled on each end with "E-Z markers" or equivalent.
 - 12. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its termination.
 - 13. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels.

14. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.
 15. All wiring shall be executed in strict adherence to standard practices. All conduits shall be well spaced from power conduits, and shall be properly grounded to the building grounding electrode system ground. Lines in conduit are not to be spliced.
- C. All boxes, conduits, etc., shall be of proper size, shall be clearly marked for easy identification, continuously grounded together and bonded to the building grounding electrode system via the MDF and IDF ground bars. The Division 27 Trade shall furnish special boxes to the Electrical Trade for installation by the Electrical Trade.
- D. All data cables for Owner furnished PoE phones shall be installed from indicated wall locations to the nearest data rack. Installation of data cabling shall be per Specification Section 27 20 00. All testing shall be as specified in Specification Section 27 20 00.

3.2 FIELD QUALITY CONTROL

- A. The Communication System Trade shall submit the following information to the Architect/Engineer.
1. "As-built" conduit, conduit sleeves and cable layout diagrams with conduit labels and cable labels.
 2. Cable testing data.
- B. Final tests and inspection shall be held in the presence of Engineer's representatives and to their satisfaction. The System Trade shall supply personnel and required auxiliary equipment for this test without additional cost.
- C. The completed cabling system for the Phone System shall be tested to insure that it is operating properly. Coordinate with the Owner's electronic component provider for equipment to be installed by this contractor, connections to phones. Acceptance of the systems shall also require a demonstration of the stability of the systems. This shall be adequately demonstrated if the systems operate for a ninety (90) day test period without any problems. Should a problem occur, the System Trade shall readjust or replace the defective cabling components and begin another ninety (90) day test period. This test shall not start until the Owner has obtained beneficial use of the building under tests.
- D. If the requirements provided in the paragraph above are not completed within one (1) year after beginning the tests described therein, the System Trade shall replace cabling components with another acceptable manufacturer and the process repeated until acceptance of the equipment by the Architect/Engineer

END OF SECTION

SECTION 280500
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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 WORK INCLUDED

- A. Every item of labor, material, devices and appurtenances for installing a complete electronic Safety and Security System and other related systems included in Division 28 of the Specifications.
 - 1. Section 28 05 26 - Grounding and Bonding for Electronic Safety and Security Systems
 - 2. Section 28 05 28 - Pathways for Electronic Safety and Security
 - 3. Section 28 05 53 - Identification for Electronic Safety and Security
 - 4. Section 28 13 00 - Electronic Access Control
 - 5. Section 28 20 00 - Electronic Surveillance
 - 6. Section 28 31 00 - Fire Detection and Alarm

1.3 RELATED WORK

- A. General: See all other portions of these Contract Documents and apply to those portions of work, relating to the following Electronic Safety and Security Systems: Electronic Access Control, Fire Detection and Alarm, Electronic Surveillance, the same as if repeated herein in its entirety. The Division 28 Trades shall provide and install all wiring, all equipment, all electronics, all software and accessories as specified and shown on the drawings and as needed to provide complete and operational systems. Division 28 Trades shall provide to Division 26 special boxes, cabinets, racks, hangers, and etc. for installation.
- B. Division 21 – Fire Suppression
- C. Division 23 – Mechanical
- D. Division 26 – Electrical
- E. Division 27 – Communications

1.4 WORK NOT INCLUDED

- A. Provide roughing-in, including the empty boxes, conduit, pull strings, etc. under Division 26 for the following related Sections:

1. Section 28 05 26 - Grounding and Bonding for Electronic Safety and Security Systems
2. Section 28 05 28 - Pathways for Electronic Safety and Security
3. Section 28 05 53 - Identification for Electronic Safety and Security
4. Section 28 13 00 - Electronic Access Control
5. Section 28 20 00 - Electronic Surveillance
6. Section 28 31 00 - Fire Detection and Alarm

1.5 DRAWINGS

- A. Where conduit, equipment, devices and other electrical appurtenances are shown on the drawings, the general arrangement of such items on the electrical drawings shall be followed as closely as actual building construction and the work of other trades will permit. Because of the small scale of the electrical drawings, it is not feasible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the construction conditions affecting the work and provide fittings and accessories as required to meet actual conditions.

1.6 QUALITY ASSURANCE

- A. Equipment and material used in the project shall be new and undamaged. The installation shall fit into the space allotted and shall allow adequate, acceptable, clearances for entry, servicing, safety, and maintenance. The Contractors shall coordinate the work to ensure that the equipment may be moved into place without altering building components or other installations. All electronic safety and security systems (above) work shall be performed by a Commonwealth of Virginia Class-A licensed Electrical Contractor(s) whose technicians, mechanics, or tradesmen shall be skilled and certified in the trade involved. All Division 28 work shall be performed under the direct supervision of the equipment systems' authorized technician with a locally recognized and accepted master electrician's license. All work under Division 28 shall be provided by a single-source Division 28 vendor/subcontractor approved by the Owner to be utilized for this work.

1.7 REFERENCES

- A. The complete installation and all materials and equipment under Division 28 shall conform to the current Commonwealth of Virginia Statewide Building Code including all applicable portions of the National Electrical Code (NEC) and all other governing codes, regulations and certifications. All wiring methods shall adhere to Division 28 specified wiring methods.
- B. All equipment used shall bear the Underwriters Laboratory (U.L.) label for the intended application, or other organizations label if acceptable to the Authority having jurisdiction and concern with product evaluation.
- C. In addition, the following codes, standards, and regulations shall apply to the complete installation and all materials and equipment. These are referred to by their accompanying abbreviations.

1. National Electrical Code (NFPA No. 70) 2014.....NEC
2. National Electrical Manufacturers Association.....NEMA
3. Underwriters Laboratories, Inc.UL
4. Telecommunications Building Wiring StandardsTIA /E IA
5. All Systems Installation Certification Compliance Documents for Installing Trades
6. National Fire Protection Association (NFPA No. 72) 2013.....NFPA
7. Uniform Federal Accessibility Standards.....UFAS
8. Americans with Disabilities Act Accessibility GuidelineADAAG

- D. The above standards are intended as a minimum and shall be exceeded if required by the Contract Documents. In the event information contained in the Contract Documents conflicts with one of the above mentioned codes, the codes shall take precedence.

1.8 PERMITS, LICENSES, TAXES AND INSPECTION CERTIFICATES

- A. All permits, bonds, licenses, inspection fees and taxes required for the execution of the work shall be obtained and paid for by the Contractor. Under each phase of the Division 28 work, the Contractor shall furnish three copies of certificates of final acceptance to the Engineer from any inspection authority having jurisdiction.
- B. At the completion of the job, provide the Engineer with three (3) copies of the fire alarm inspection certificate from the Authority having jurisdiction, if such inspection is provided and/or required by the locality.

1.9 REGULATIONS AND STANDARDS

- A. The completed installation and all materials and equipment shall conform to local ordinances and codes, other regulations and standards listed herein or in related sections. These are intended as a minimum and shall be exceeded if required by the specifications or the Drawings. In the event of conflict between the codes, standards, or regulations, and information contained in the Contract Documents, the applicable code, standards, or regulation shall take precedence.

1.10 SUBMITTALS

- A. Submit shop drawings, product data and samples in accordance with Division 1 for all items as specified in related sections of these specifications. One (1) electronic (PDF) copy of the submittal shall be submitted. One (1) electronic (PDF) copy of the submittal will be returned to the Contractor. If additional copies are required they will be the responsibility of the Contractor. Where drawings are submitted, the Contractor shall submit a minimum of two (2) sets of full scale prints. One (1) copy will be marked and returned to the Contractor, and the Contractor shall be responsible for all additional copies required for his use. All submittal data shall be correctly identified to show project name, and the exact model, style or size of item being submitted. Improperly identified submittals will not be reviewed by the Engineer. Each item submitted for review shall bear the Subcontractor's stamp which states that they have reviewed the submission, that it is complete, and that in their opinion it meets the contract requirements. Contractor's stamp shall identify the paragraph and page number for which the submittal is being made. Any submission which has not been reviewed and

stamped by the Electrical Trade will not be reviewed by the Engineer. No reviews prior to award of Contract will be considered or accepted. Provide all submittals 60 days from notice to proceed. Owner shall be copied on submittals, reports and correspondence.

- B. Shop drawings, diagrams, catalog data and such other data necessary to fully describe and substantiate compliance with these Contract Documents shall be submitted as follows:
 - 1. All the equipment and materials where submissions are specifically required by other Divisions of these Contract Documents.
 - 2. All the equipment and materials that are indicated with a [S] behind the product title. This shall include submission of the specified products equipment and materials.
 - 3. All the equipment and materials that are acceptable equal substitution.
 - 4. If submission is NOT required for the SPECIFIED products "shop drawings and product data" under Items 1 and 2 above, the Contractor shall NOT submit the SPECIFIED products "shop drawings and product data".
 - 5. Samples, in good working order, shall be submitted in accordance with Division 1, complete with all installation and service drawings and instructions. All samples will be returned at the submitter's expense unless otherwise indicated. Samples may be subject to destructive testing by Engineer.
- C. Operation and Maintenance manuals shall be submitted in accordance with Division 1 and shall include a copy of all accepted shop drawings, installation and maintenance data, operation instructions, parts lists, and the name, address and telephone number of supplier or nearest representative. All electrical and electronic devices, equipment and systems marked [O/M] in these specifications shall be included and all other such electrical and electronic items which will require servicing before the duration of its useful life has been reached. Manuals shall be presented to the Engineer for review and transmitted to the Owner before the final payment is recommended.
- D. Equivalents:
 - 1. Not all of the Manufacturers, trade names and/or model numbers are indicated herein, or on the drawings.
 - 2. Unless definitely stated otherwise and upon complying with Division 1, the Contractor may use any article of equal appearance, which in their judgment is equal to the article that is specified and is accepted by the Engineer.
 - 3. Where three (3) or more manufacturers are named in the specifications for any item, the Contractor shall use one of the three (3) listed manufacturers. No other manufacturers shall be reviewed or accepted. Manufacturers that are listed first in these specifications and on drawings were used as a basis of design.
 - 4. It will be the responsibility of the Contractor to verify all connections, physical sizes and capacities of all other manufacturer's items, both named or proposed. If the equipment necessitates changes in power distribution, conduit, wiring, lighting, wiring, or any other building systems from that indicated on the drawings, the Contractor shall be responsible for all additional costs included and notify other trades of the changes. Where such changes are required, detail

drawings indicating all required changes shall be submitted for review at the same time the manufacturers drawings are submitted for approval.

5. Refer to Division 1 for substitutions.

- E. The ten days prior approval requirements of The Instructions to Bidders, A IA 701, are waived for this Division of the Specifications, and unless stated otherwise, the Contractor may use items that he deems as equivalent in quality and performance to the specified item subject to final acceptance of substituted items by the Engineer upon his review of shop drawings.
- F. Guarantee: Electronic safety and security systems equipment, materials and labor required by these specifications and accompanying drawings shall be guaranteed to be free from defective materials or workmanship for a period of one year after final acceptance of the project except extended warranties as specified elsewhere in these documents on specific items of equipment will be furnished by the Trade providing the equipment. Defects in material or workmanship occurring during this period shall be corrected with new material and equipment or additional labor at no cost to the Owner. Manufacturer's certificates of warranty shall be transmitted to the Owner before final payment is recommended.

1.11 WARRANTIES

- A. The Contractor shall warrant for a period of one year all work provided under the Contract to include, but not necessarily limited to, all systems, equipment, materials, and workmanship. This shall not be construed to limit any extended warranty periods of longer than one year for specific items or systems specified elsewhere in the Contract Documents.
- B. The warranty period shall commence on the date of acceptance by the Owner and shall cover all parts and labor as required to fulfill the warranty at no cost to the Owner.
- C. Refer to Division 1 for additional warranty requirements.
- D. Information on all warranties shall be included in the O&M manuals specified herein to be provided to the Owner.

1.12 COORDINATION OF WORK

- A. General: The contract documents indicate the extent and general arrangement of the electronic safety and security systems. The Contractor shall be responsible for the coordination and proper relation of the electronic safety and security system work to the building structure and to the work of other trades. No additional compensation or extension of completion time will be granted for extra work caused by the lack of coordination.
- B. Cooperation: The Contractor shall provide dimensions and locations of all openings, shafts and similar items to the proper trades and install work as required so as not to interfere with, or delay, installation of systems under construction in the buildings.

- C. Locations of lines and equipment shall be determined from actual field measurements. The outlines of the building shown on the electrical drawings are intended only as a guide to indicate relative locations of the electronic safety and security work. Refer to the existing buildings and structural components to determine actual measurements. If conflicts prevent installation of electronic safety and security work at the locations indicated, minor deviations shall be made subject to acceptance by the Engineer, and without additional compensation.
- D. Cutting and Patching: See Division 1 and Division 26.
- E. Roughing-In: Equipment, racks, cabinets, manual pull stations, smoke detectors, devices, and other similar items shall align vertically or horizontally with each other, the building structure and features thereof when it appears obvious and logical that they should. All mounting heights shall be within the limits of Commonwealth of Virginia USBC and ADAAG.
- F. Damage to Other Work: The Division 28 Trades are responsible for damage to other work caused by his work or workmen. Repairing of damaged work shall be done by the Trade who installed the work, and as directed by the Engineer; the cost of which shall be paid for by the Division 28 Trades.

1.13 ASBESTOS

- A. Asbestos Free Materials: The intention of these drawings and specifications is that there be no asbestos containing materials installed on this project. To the best of the Engineers' knowledge, none of the material or equipment specified herein or shown on the drawings contain asbestos. The Contractor shall make every effort to prevent any asbestos materials from being installed in or used on the construction of the project. At the completion of the project, the Contractor shall certify by letter that to the best of his knowledge, no asbestos containing materials were used for or in the construction of this project.

PA RT 2 - PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. General: Manufacturers and materials shall be as specified in subsequent sections of these specifications and as noted on the drawings. Similar types of equipment shall be the products of the same manufacturer unless specified otherwise.

2.2 SLEEVES AND INSERTS

- A. General: Sleeves and inserts shall be provided and correctly located in the structure, as required for the work.
- B. Inserts shall be steel and of proper size for loads encountered.

2.3 ACCESS DOORS

- A. Provide for all junction boxes or any item requiring access. Doors shall be of sufficient size and so located that the concealed items may be serviced or completely removed and replaced. Doors required for work shall be furnished as a part of this Division to the General Contractor for installation. Doors in acoustic tile ceilings shall be furnished in multiples of tile sizes. Doors are not required in exposed grid type ceilings where tiles are removable. Doors shall be metal access doors with cam lock, style to match ceiling or wall construction. Doors occurring in rated construction shall be fire rated U.L. labeled access doors correlated to preserve the integrity of the rated construction. Doors shall be prime finish steel except those in toilets, shower rooms, locker rooms, kitchens and other similar areas shall be aluminum with natural anodized finish. Doors shall match the access doors in Division 23 and meet the acceptance of the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Materials and equipment shall be installed in accordance with manufacturer's instructions to conform with the details and application as specified in subsequent sections of these specifications and indicated on the drawings.
- B. Supports: Provide necessary supports for all equipment and appurtenances as required; this includes, but is not limited to, frames or supports for items such as cabinets, junction boxes, conduit, outlet boxes, and other similar items requiring supports. Foundation drawings, bolt setting information and foundation bolts shall be furnished by the subcontractors furnishing the equipment for all equipment required to be bolted to the floor, wall or above ceiling structure.
- C. Sleeves: Provided by Division 26.
- D. Temporary Requirements: Openings in equipment shall be kept capped at all times until connection is made to the system. The ends of all conduits and equipment openings shall be kept capped properly with approved devices. Approved devices are items such as specially molded plastic caps and sheet metal caps.
- E. Access Doors: Provide access doors for all concealed electric equipment, pull boxes, junction boxes or any item requiring access. Doors shall be of sufficient size and so located that the concealed items may be serviced or completely removed and replaced. Doors required for Division 28 work shall be furnished by Electrical Trade to the Contractor for installation. Doors in acoustic tile ceilings shall be furnished in multiples of tile sizes. Doors are not required in exposed grid type ceilings where tiles are removable.
- F. Painting: All work under this Division shall be painted in accordance with Section 28 05 53, Identification for Electronic Safety and Security Systems.

3.2 FIELD QUALITY CONTROL

- A. Verification [V]: Upon completion of the project, the Contractor shall submit a separate letter of certification (or compliance) to the Owner/Engineer that each of the following systems or equipment functions properly, conforms to all requirements of these specifications and all requirements of the manufacturer of the systems.
1. Section 28 13 00 – Electronic Access Control
 2. Section 28 20 00 – Electronic Surveillance
 3. Section 28 31 00 – Fire Detection and Alarm

3.3 MANUFACTURER'S ASSISTANCE

- A. Qualified technical representatives of manufacturers shall be available to visit the project and provide required assistance for any problems or trouble areas of any systems, material or equipment used in the project. Manufacturer's engineering assistance shall also be available for above problems or trouble areas. The Contractor shall purchase all materials, equipment or systems with these services included in the purchase price or otherwise be prepared to have the above service provided when needed or requested by the Engineer without additional compensation. Where one manufacturer's equipment constitutes the majority of the components or devices to make a system, the manufacturer's technically qualified representative shall inspect and accept the completed installation whether or not especially requested by the Engineer.

3.4 INSTRUCTION AND TRAINING OF OWNER'S REPRESENTATIVE

- A. The Division 28 Trades shall instruct and train the representatives of the Owner in the proper operation and maintenance of all elements of the Electronic safety and security systems. Competent representatives of the Contractor shall spend one (1) week for each Division 28 system. The times and locations for instruction and training to the Owner's personal shall be set by the Owner at times and locations determined by the Owner over a period once the systems are functional for instruction and training. The instruction and training shall be given to all personal as deemed necessary by the Owner. The instruction and training shall prepare the Owner to fully operate and maintain all of the above systems.

3.5 CONSTRUCTION STATUS REPORT

- A. Each item of discrepancies noted on Construction Status Report prepared by the Architect/Engineer shall be answered in detail in writing by the Contractor before payment can be recommended.

3.6 DESCRIPTION OF ALTERNATES

- A. Refer to the other Divisions of the Contract Specification (Manual) for description of alternates.

END OF SECTION

SECTION 280526
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

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 WORK INCLUDED

- A. Equipment Grounding Conductor
- B. Grounding for Data and Telecommunications Systems

1.3 RELATED WORK

- A. Section 260526 — Grounding and Bonding for Electrical Systems
- B. Section 270526 — Grounding and Bonding for Communication Systems
- C. Division 26 – Electrical

1.4 REFERENCES

- A. NFPA 70 (NEC), Article 250

1.5 DESCRIPTION

- A. An insulated equipment grounding conductor, color coded per section 26 05 53, and the NEC, shall be provided for each alternating current circuit without exception.

1.6 TESTS

- A. The equipment grounding conductor shall be tested for continuity and proper bonding to metallic equipment enclosures, outlet boxes, wiring devices and similar items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Data Room Ground Bus Bar: Refer to 26 05 26, 3.2, K.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Grounding Conductor:

1. Provide a separate insulated grounding conductor, color-coded as per Section 26 05 53, enclosed in the same raceway with the phase conductors for all alternating current circuits, even though not necessarily shown on the drawings.
2. The equipment grounding conductor shall be secured to the equipment enclosure at the source of power and at the apparatus being served by the alternating current supply.
3. The minimum size for the grounding conductor shall be as specified in Table 250.122 of NEC.

B. Data Room Ground Bus Bars:

1. Provide a separate insulated grounding conductor (#3/0 AWG) between the IDF bus bar homerun back the nearest ground electrode.
2. Provide a separate insulated grounding conductor (#6 AWG) between each rack or cabinet to the IDF ground bus bar using cut-washer, double hole/double crimp grounding lugs, nuts, bolts and washers. Cut or sand paint away from rack or cabinet area where grounding lug is attached. Do not connect more than one rack or cabinet to a single ground wire.
3. Provide a separate insulated grounding conductor (#6 AWG) between each piece of electronic equipment (contract provided or Owner provided) located in each rack or cabinet to the respective rack or cabinet in each data closet using cut-washer, double hole/double crimp grounding lugs, nuts, bolts and washers. Cut or sand paint away rack or cabinet and equipment area where grounding lug is attached. Do not connect more than one piece of equipment to the rack or cabinet with a single ground wire.

END OF SECTION

SECTION 280528
PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

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 WORK INCLUDED

- A. Empty conduit system for Electronic Safety and Security Systems including Electronic Access Control and Intrusion Detection, and Electronic Surveillance.

1.3 RELATED WORK

- A. Section 26 05 00 — Common Work Results for Electrical
- B. Section 26 05 26 — Grounding and Bonding for Electrical Systems
- C. Section 26 05 33 — Raceway and Boxes for Electrical Systems
- D. Section 26 05 53 — Identification for Electrical Systems
- E. Section 28 05 00 — Common Work Results for Electronic Safety and Security
- F. Section 28 05 26 — Grounding and Bonding for Electronic Safety and Security Systems
- G. Section 28 05 53 — Identification for Electronic Safety and Security

1.4 GENERAL OPERATION AND DESCRIPTION

- A. General: The Electronic Access Control and Intrusion Detection and Electronic Surveillance systems shall consist of a complete (partial) empty conduit system as indicated.
- B. The raceway for this system shall be furnished and installed by the Division 26 electrical contractor in accordance with all related specification sections in Division 26 and 28. The Electronic Safety and Security System Trade shall coordinate this work with Division 26.

1.5 REFERENCES

- A. The complete installation, including additions and modifications, shall be in accordance with:
 - 1. National Electrical Code Article 800.
 - 2. Minimum standards of Electronics Industries Association (EIA).

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The Contractor shall provide all conduit, junction boxes, and materials required for the installation of an empty conduit Electronic Safety and Security System in accordance with the specifications and drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification.
- B. Wiring:
 - 1. Partial Conduit Raceway System: All wiring methods (conduit only) shall be in accordance with NFPA-70, Article 800, and all other codes specified herein. All wiring to be installed under another contract.
 - 2. Electronic Safety and Security Raceway System: Provide empty raceway system for motion detection, card readers, key pads, camera, and other electronic safety and security systems outlets and/or devices with conduit, boxes, cabinets, etc., as shown. Outlets, raceways and plates as specified in Division 26. All conduit runs to have long sweep radius elbows; condulets not permitted. There shall be a maximum of two 90° bends between outlets. Any run over 100'-0" in length shall have a pull box where approved by the Electronic Safety and Security System Trade. Provide fish wires as previously specified. Cabinets shall be flush or surface mounted as required.
 - 3. Provide all conduit raceway runs of size and quantity as indicated on drawings and as specified below. Provide a 1" conduit raceway from each device junction box to be stubbed and bushed out above the nearest accessible ceiling. From this location provide J-Hooks or utilize cable tray to extend wiring to MDF or IDF rooms. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ells.
 - 4. All Electronic Safety and Security systems conduits, boxes, etc., shall be grounded to the building grounding electrode system and properly bushed.
- C. All boxes, conduits, etc., shall be of proper size, as determined by the Electronic Safety and Security Trade and shall be clearly marked for easy identification.

3.2 FIELD QUALITY CONTROL

- A. The Contractor shall submit the following information to the Architect/Engineer: "As—built" conduit layout diagrams.

END OF SECTION

SECTION 280553
IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY SYSTEMS

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 WORK INCLUDED

- A. Prepare and paint Division 28 equipment supports and miscellaneous materials located in Equipment Rooms, IDF's, MDF and other utility areas housing mechanical, electrical, safety and security equipment.
- B. Identification of cabinets, racks, equipment and other system enclosures.

1.3 WORK NOT INCLUDED

- A. Painting of factory finished Division 28 Equipment such as Access Control, Electronic Surveillance, Fire Detection and Alarm, etc.

1.4 RELATED WORK

- A. Section 26 05 53 — Identification for Electrical Systems
- B. Section 27 05 53 — Identification for Communications
- C. Section 28 05 00 — Common Work Results For Electronic Safety And Security
- D. Section 28 05 28 — Pathways for Electronic Safety and Security
- E. Section 28 10 00 — Electronic Access Control
- F. Section 28 20 00 — Electronic Surveillance
- G. Section 28 31 00 — Fire Detection And Alarm

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Except as otherwise specified, materials shall be the products of the following manufacturers:
 - 1. Sherwin-Williams
 - 2. Pratt and Lambert
 - 3. Pittsburgh Plate Glass (PPG)
 - 4. Benjamin Moore

2.2 MATERIALS

- A. Deliver all paints and materials to the project site in their original containers with all labels intact and legible at the time of use.
- B. All paints, coatings and primers applied inside the weatherproofing system and applied on site shall meet the VOC requirements of Green Seal Standard GS-11.
- C. All anti-corrosive and anti-rust paints, coatings and primers applied inside the weatherproofing system and applied on site shall meet the VOC requirements of Green Seal Standard GS-03.
- D. Sherwin-Williams Industrial Maintenance Coatings System 4000 products are listed below to establish color and a standard of quality.
 - 1. All Hangers and Supports: One coat Series 54 Gloss Black Alkyd Enamel.
 - 2. Factory Finished Equipment finishes shall be cleaned and properly touched up with equipment manufacturers touch-up paint unless finish is severely damaged or of unacceptable quality. In the latter case, the entire finish shall be restored in accordance with painted procedures herein specified.
- E. Paint for this project shall be pre-catalyzed epoxy paint.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. The work shall be accomplished by qualified mechanics skilled in the painting trade. Painting of equipment and other materials shall not commence until all testing is complete and systems are ready for operation. Materials shall be evenly spread, and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coats.

3.2 PROTECTION OF WORK

- A. The painters shall protect all adjacent surfaces with drop covers during the process of painting. Upon completion, paint spots, if any, shall be removed from all surfaces not intended to be painted.

3.3 PREPARATION OF SURFACE

- A. Surfaces to be painted shall be completely dry before applying paint. Metal surfaces shall be cleaned with mineral spirits before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be chemically treated with crystalline zinc phosphate in strict accordance with the manufacturer's recommendations. Surfaces shall not be painted when the temperature is, or is likely to be, near the freezing point, nor when they are exposed to hot sun.

3.4 IDENTIFICATION OF PIPES AND EQUIPMENT

- A. After all painting is completed, operating and control parts of the equipment and systems such as cabinets, racks, telephone cabinets, and system cabinets shall be properly identified with laminated engraved plastic nameplates fastened with sheet metal screws, bolts or permanent adhesive. Pressure sensitive tape is not acceptable. Identification symbols or designations shall be the same as shown on the contract documents.
- B. Boxes; Concealed and Surface Mounted: Each enclosure shall be neatly identified by stencil marking, which shall indicate service contained, circuit numbers (or zone numbers). Stencil letters shall be upper case (Capital) not less than one (1) inch high and painted with Series 54 black gloss enamel. All fire alarm system boxes shall be painted red.
- C. The Division 28 Systems shall have an engraved informational laminated nameplate with the installing trade's name, telephone number and address for the Owner to obtain preventive maintenance, service or parts. The nameplate shall include the job order number, shop number or other identification, which will identify the related equipment.
- D. If the above address and telephone number is a branch office, the main office or manufacturer's address and telephone number shall be included.

END OF SECTION

SECTION 282000
ELECTRONIC SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Conduit system, conduit sleeves, cabling and exterior pole for connections to Owner furnished CCTV cameras, mounts and electronics for Electronic Surveillance System. Contractor shall install Owner furnished equipment and test.

1.2 RELATED WORK

- A. Division 8 — Openings
- B. Division 26 — Electrical
- C. Section 272000 — Data Communications
- D. Section 280500 — Common Work Results for Electronic Safety and Security
- E. Section 280526 — Grounding And Bonding for Electronic Safety and Security Systems
- F. Section 280553 — Identification For Electronic Safety and Security

1.3 GENERAL OPERATION AND DESCRIPTION

- A. General: The electronic surveillance system shall consist of a partial empty conduit system, conduit sleeves, cabling and exterior poles as indicated. Install and test all of the Owner provided CCTV equipment.

1.4 REFERENCES

- A. The complete installation, including additions and modifications, shall be in accordance with:
 - 1. National Electrical Code Article 725 & 800.
 - 2. Minimum standards of Electronic Industries Association (EIA).

1.5 SUBMITTALS

- A. Submit shop drawings product data and Virginia Licenses (copy) in accordance with Section 28 05 00.
 - 1. Shop Drawings: The electronic surveillance system manufacturer and Trade shall provide a one-line riser diagram indicating route, conduit size, data wiring, external wiring, cable testing and connections of system proposed, also furnish complete operating instructions, including schematic and wiring diagrams of the system, engineering data sheets on each component and complete servicing data including part numbers of the various components. A schematic diagram of the complete system is not shown on the contract documents.
 - 2. Product Data: Submit application, technical, and installation data.
 - 3. Virginia "Private Security Services License": Submit copies, for the employer and certification of employees with the shop drawings.

- B. Submit Operation and Maintenance Manuals in accordance with Section 28 05 00.

1.6 WARRANTY, SERVICES

- A. The electronic surveillance system Trade shall warrant this System expansion for a minimum of one (1) year from date of acceptance by Owner against defective parts and/or workmanship and shall provide parts and labor to fulfill this warranty at no cost to Owner. This warranty shall not apply if damage is caused by abuse, accident, improper operation or negligence.
- B. Refer to Division 1 and Section 280500 for submission of warranty.
- C. Qualified service and parts shall be available to call on within a 150 mile basis.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The cables (indoor and indoor/outdoor and plenum rated) for all cable runs shall be based on General Cable.
- B. LAN for connections to cameras, data outlets and patch panel shall be as specified in Section 27 20 00 Data Communications.
- C. The multiple port station outlets, patch panels and wire management devices shall be as specified in Section 27 20 00 Data Communications.
- D. It is recommended that the successful bidder of the section acquire the services of the successful bidder of Section 27 20 00 for providing and installing data cabling, all data cabling terminations, testing, jacks, faceplates and jumpers. This is in efforts to keep the data cabling and respective data components as one uniform system supplied from one manufacturer across Division 27 and 28 Sections. The successful bidder of this section is still responsible for all components of this section.

2.2 SYSTEM COMPONENTS

- A. Cables for Data Network: (Plenum rated for indoor and indoor/outdoor cables):
 - 1. Horizontal Distribution: LAN: (Voice) Four(4) twisted-pair and meet all TIA/EIA Category 6 specifications as indicated in Section 27 20 00 Data Communications. The cable shall be plenum rated inside and outdoor rated outside.
 - 2. Patch Panel Cables Jumpers:
 - a. Patch Panel Cables: Four (4) twisted-pair with RJ-45 connectors on both ends and meet all TIA/EIA Category 6 specifications indicated in Section 27 20 00 Data Communications.

- b. CCTV Camera Outlet Jumper Cables: Four (4) twisted-pair with RJ-45 connectors on both ends and meet all TIA/EIA Category 6 specifications indicated in Section 27 20 00 Data Communications. Coordinate exact lengths in the field.
 - c. Provide surge suppressors for all exterior connections. Tripp-Lite Premium Network Surge Suppressors or equal.
- B. Outlet Termination Devices:
 - 1. Single gang 2 port 100 style Faceplate as indicated in Section 27 20 00 Data Communications.
 - 2. Category 6 (RJ45) Jack as indicated in Section 27 20 00 Data Communications.
 - 3. Blank Inserts as indicated in Section 27 20 00 Data Communications.
 - 4. CCTV DATA Icon - shall be red and unique from data and CCTV camera icons.
- C. Install and test all components of the cable for the Owners CCTV system. Owner's forces shall provide and install the cameras, camera mounts, CCTV equipment and software.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The electronic surveillance system Trade shall provide all conduits, junction boxes, and materials required for the installation of a conduit system, conduit sleeves, cables, jumpers, surge suppression, enclosures, converters, receptacles and etc., in accordance with the specifications and drawings. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this specification.
- B. Wiring:
 - 1. Conduit, Raceway, conduit sleeves, cable tray and J-Hook System: Provide proper number and size of conduits, boxes and hangers as required for cable pathway. All wiring methods shall be in accordance with NEC 800, and applicable TIA/EIA specifications.
 - 2. Electronic Surveillance System Raceways: Provide raceway system for electronic surveillance system with conduit system, conduit sleeves, cables, jumpers, surge suppression, enclosures, converters, receptacles and etc., as shown. Outlets, raceways and plates as specified elsewhere herein. All conduit runs to have long sweep radius elbows; condulets not permitted. There shall be a maximum of two 90° bends between outlets. Provide fish wires as previously specified.
 - 3. Furnish and install a 1" conduit raceway from each device junction box (double-gang with single-gang plaster ring) to be stubbed and bushed out above the nearest accessible ceiling. From this location provide J-Hooks or utilize cable tray to extend wiring to MDF or IDF rooms. The minimum size of any conduit not indicated shall be 1". All bends shall be long radius ells.

4. Conduit sleeve shall be installed in interior and exterior walls as needed and indicated on the drawings. For corner wall mounted security cameras: locate junction box 6" above the top of the camera to the center of the junction box and 6" from the corner of the exterior wall to the center of the junction box. All other wall mounted security camera junction boxes shall be located behind the security camera.
 5. All outlet boxes for electronic surveillance system shall be recessed and be 4"X4"X2.125" with single gang reducing ring or as needed by the installing trade.
 6. All electronic surveillance system conduits, boxes, etc., shall be grounded to the building grounding electrode system via the MDF and IDF ground bars and properly bushed.
 7. Label the start and end of all electronic surveillance system conduits with orange bands.
 8. No wiring other than that directly associated with the system shall be permitted in these conduits or open areas.
 9. Wiring splices are not allowed.
 10. Transposing or changing color coding of wires shall not be permitted.
 11. All conductors shall be labeled on each end with "E-Z markers" or equivalent.
 12. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its termination.
 13. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels.
 14. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.
 15. All wiring shall be executed in strict adherence to standard practices. All conduits shall be well spaced from power conduits, and shall be properly grounded to the building grounding electrode system ground. Lines in conduit are not to be spliced.
- C. All boxes, conduits, etc., shall be of proper size, shall be clearly marked for easy identification, continuously grounded together and bonded to the building grounding electrode system via the MDF and IDF ground bars. The Division 28 Trade shall furnish special boxes to the Electrical Trade for installation by the Electrical Trade.
- D. All data cables for Owner furnished PoE CCTV cameras shall be installed from indicated camera location to the nearest data rack. Installation of data cabling shall be per Specification Section 27 20 00. All testing shall be as specified in Specification Section 27 20 00.

3.2 FIELD QUALITY CONTROL

- A. The Electronic Surveillance System Trade shall submit the following information to the Architect/Engineer.
1. "As-built" conduit, conduit sleeves and cable layout diagrams with conduit labels and cable labels.
 2. Cable testing data.
- B. The completed cabling system for the surveillance CCTV Systems shall be tested to insure that it is operating properly. Coordinate with the Owner's electronic component

provider for equipment to be installed by this contractor, connections to cameras and camera operation. Acceptance of the systems shall also require a demonstration of the stability of the systems. This shall be adequately demonstrated if the systems operate for a ninety (90) day test period without any problems. Should a problem occur, the CCTV System Trade shall readjust or replace the defective cabling components and begin another ninety (90) day test period. This test shall not start until the Owner has obtained beneficial use of the building under tests.

- C. If the requirements provided in the paragraph above are not completed within one (1) year after beginning the tests described therein, the CCTV System Trade shall replace cabling components with another acceptable manufacturer and the process repeated until acceptance of the equipment by the Architect/Engineer.

END OF SECTION

SECTION 283100
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials and performance of all operations in connection with the installation of the Fire Detection and Alarm System as shown on the drawings and as herein specified.
- B. The Fire Detection and Alarm System shall consist of all necessary hardware, equipment and software programming to perform the following functions:
 - 1. Fire detection and alarm operations.
- C. Selection of and contracting with an approved Central Station shall be by the Owner.

1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including the General and Supplementary Conditions, Instructions to Bidders and sections of Division 1, apply to the work specified in this section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 8 for fire door electric motors and release devices that interface with the fire alarm system.
- B. Division 8 for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.
- C. Division 11 for connections to Hood Fire Suppression Systems.
- D. Division 14 for connections required for elevator power shut-down and fireman's recall.
- E. Divisions 21 and 23 for connections required to smoke dampers and to Sprinkler System tamper, flow and pressure switches.
- F. Division 26 for conductors/cables, electrical raceways, boxes and fittings which are required in conjunction with fire detection and alarm work.
- G. Refer to Division 7 for fire-stopping sealants required around conduit and cable penetrations through fire-rated assemblies.

1.4 REFERENCES AND CODES

- A. Installer's Qualifications:

1. This Contractor shall furnish the services of a qualified fire detection and alarm system manufacturer's representative experienced in the installation and operation of the system being provided, to supervise the hook-up, final testing and adjustment of the system, and instruction to the Owner's representative. Manufacturer's representative shall maintain the installed system for a period of two years after final acceptance in compliance with Underwriter's Laboratories' guidelines. The system shall be listed and on file with Underwriter's Laboratories, Inc.
2. The Manufacturer/Supplier shall be nationally recognized company specializing in fire detection and alarm systems. This organization shall employ factory trained and NICET Level 3 minimum certified technicians, and shall maintain a service organization within 150 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years of experience in the fire protective signaling systems industry.

B. Codes and Standards:

1. The complete installation shall conform to the applicable sections of NFPA 72, NFPA 101, Local Code Requirements, Virginia Uniform Statewide Building Code, NFPA-70 National Electrical Code Article 760, and ADA Accessibility Guidelines (ADAAG).
2. All items of the Fire Detection and Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under UL-UOJZ as a single control unit.
3. All circuits must be marked in accordance with NEC Article 760.
4. All control equipment shall have transient protection devices to comply with UL 864 requirements.
5. Electrical Components Devices and Accessories: Listed and labeled as defined in NFPA-70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 SUMMARY

A. This Section includes fire alarm systems for the following:

1. Provide a complete, new integrated fire detection and alarm system in the new building. Work covered by this specification section includes the furnishing of labor, equipment, materials, and complete operational performance required for installation of the Fire Detection and Alarm System.
2. Provide new addressable Fire Alarm peripherals to all new construction areas.
3. Addressable devices shall include:
 - a. Smoke sensor with sensor base
 - b. Heat sensor with sensor base
 - c. Manual pull stations
 - d. Remote test stations and HVAC shutdown relay
 - e. Smoke sensors with programmable sounder bases in designated rooms.
 - f. Smoke sensors with programmable relay bases for control of smoke dampers.

- g. Sprinkler system flow, tamper and pressure switch modules.
- h. Horns and strobes.

4. Provide remote annunciator panels where indicated on drawings.

1.6 DEFINITIONS

- A. FACU: Fire Alarm Control Unit.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.7 SYSTEM DESCRIPTION

- A. Addressable, non-coded, multiplexed system; signal transmission dedicated to fire alarm service.

1.8 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Protected premises:
 - 1. Construction Type per Architectural Life Safety Plans.
 - 2. Occupancy Type per Architectural Life Safety Plans.
- C. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Automatic sprinkler system water flow.
 - 5. Fire extinguishing system operation.
 - 6. Fire standpipe system.
- D. Fire alarm signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Identify alarm at the FACU and remote annunciator.
 - 3. De-energize electromagnetic door holders.
 - 4. De-energize electromagnetic door locks in the egress path.
 - 5. Transmit an "alarm" signal to the fire alarm central monitoring facility.
 - 6. Close motorized fire doors.
 - 7. Activate alarm system.
 - 8. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode only upon activation of HVAC related detectors.
 - 9. Close smoke dampers in air ducts of system serving zone where alarm was initiated.

10. Elevator recall, where applicable.
 11. Record events in the system memory.
 12. Record events with the system printer.
- E. Supervisory signal initiation shall be by operation of a fire-protection system valve tamper.
- F. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line and notification-appliance circuits.
 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at the FACU.
 4. Ground or a single break in FACU internal circuits.
 5. Abnormal AC voltage at the FACU.
 6. A break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at the FACU or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air pressure switch operation on a dry-pipe or pre-action sprinkler system.
- G. System Trouble and Supervisory Signal Actions: Initiate trouble alarm and annunciate at the FACU and remote annunciator. Record the event with the system printer.

1.9 SUBMITTALS

- A. Product Data: Submit for each type of product indicated. Each specific item required by these specifications shall be marked on the product data or shop drawings. Failure to do so is grounds for rejection of the submittal.
- B. Shop Drawings:
1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.
 2. System Operation Description: Detailed description for this project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 4. Floor Plans (Drawn to scale not less than 1/8" = 1'-0"): Indicate location of all devices and control equipment. Show conduit sizes, cables, and wire types and sizes to each device and control equipment.
 5. Sequence of operation in an input/output matrix format.
 6. Equipment technical data sheets.
 7. Batteries: Size calculations. Provide system power and battery charts with performance graphs and voltage drop calculations to assure that the system will

operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

8. Device Address List: Coordinate with final system programming.
 9. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 10. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 11. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 12. Alarm Signaling Service: Equipment rack or console layout, grounding schematic, and single-line connection diagram.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals and product data for each system component. Comply with NFPA 72 recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACU.
- E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. Upon receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- F. Submittals to Authorities Having Jurisdiction: The A/E will review and attach his approval to the fire alarm submittal (including all corrections, if any, required by the A/E after the original submittal and all re-submittals), then send one complete copy of the "approved" submittal to the authority having jurisdiction for review. The contractor shall revise and resubmit, through the A/E for approval, to the authority having jurisdiction as required for acceptance. The authority having jurisdiction is the Director, Division of Engineering and Buildings, c/o Bureau of Capital Outlay Management.
- G. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
 - b. Electronic media may be provided to Architect and authorities having jurisdiction.

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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. FACU and Equipment:
 - a. SimplexGrinnell LP; Tyco International Company.
 - b. Siemens Building Technologies, Inc.
 - c. Notifier.
 - d. Gamewell FCI.
 - e. Edwards Systems Technology, Inc.
 - 2. Wire and Cable:
 - a. Comtran Corporation
 - b. Helix/HiTemp Cables, Inc.; a Draka USA Company
 - c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company
 - d. West Penn Wire/CDT; a division of Cable Design Technologies
 - e. Belden Wire and Cable Company
 - 3. Other Manufactures of Audible and Visual Signals that are acceptable:
 - a. Wheelock; a Cooper Company
 - b. Gentex Corporation
 - c. System Sensor; a GE-Honeywell Company

2.2 FIRE ALARM CONTROL UNIT (FACU)

- A. General Description:
 - 1. Fire Alarm Control Unit enclosure shall be surface mounted.
 - 2. Addressable fire alarm system with modular, power-limited design with electronic modules, listed as UL 864 9th Addition. The system shall use closed loop initiating device circuits with individual zone supervision, individual notification appliance circuit supervision and incoming and standby power supervision.
 - 3. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

4. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACU and addressable system components, including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters each, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Circuits:
1. Signaling Line Circuits (SLC): NFPA 72, Class B: Install quantity of addressable devices that total to or are less than 75 percent of the full load of each signaling line circuit.
 2. Notification-Appliance Circuits (NAC): NFPA 72, Class B.
 3. Actuation of alarm notification appliances, annunciation, elevator recall, shall occur within 10 seconds after the activation of an initiating device.
 4. Electrical monitoring for the integrity of wiring external to the FACU for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shutdown.
- D. Notification-Appliance Circuit: Operation shall sound in a pattern approved by the authority having jurisdiction (AHJ) .
- E. Elevator Controls: Heat detector operation shall shut down elevator power by operating a shunt trip in a circuit breaker feeding the elevator.
1. A field-mounted relay actuated by the fire detector or the FACU shall close the shunt trip circuit and operate building notification appliances and the annunciator(s).
- F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the AC power shall be from a dedicated DC power supply, and power for the DC component shall be from the AC supply.
- G. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACU and remote annunciator after initiating devices are restored to normal.
1. Alarm-silence switch operation shall halt alarm operation of notification appliances and activate an "alarm-silence" light. Display of identity of the alarm zone or device shall be retained. The alarm-silence switch shall not turn off the visual indicating devices.
 2. Subsequent alarm signals from other devices or zones shall reactivate notification appliances until silencing switch is operated again.
 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances shall operate again until alarm silence switch is reset.

- H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACU and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- I. Transmission to Fire Alarm Central Monitoring Facility: Automatically transmit alarm, trouble, and supervisory signals to a fire alarm central station monitoring facility through a digital alarm communicator transmitter and telephone lines or digital cellular service.
- J. Service Modem:
 - 1. Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
 - 2. The dial-in port shall allow remote access to the FACU for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands shall initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- L. Primary Power:
 - 1. 24-VDC obtained from 120VAC power via a dedicated circuit and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal and digital alarm communicator transmitter shall be powered by the 24VDC source.
 - 2. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- M. Secondary Power: 24VDC supply system with batteries and automatic battery charger and an automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
 - 2. Battery and Charger Capacity: Comply with NFPA 72.
- N. Surge Protection: Install surge protection on normal AC power for the FACU and as recommended by FACU manufacturer.

2.3 MANUAL FIRE ALARM STATIONS

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mount on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type, with integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACU.
2. Station Reset: Key- or wrench-operated switch.
3. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

2.4 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24VDC nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACU.
3. Multipurpose type, containing the following:
 - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACU.
 - b. Piezoelectric sounder base rated at 88 dBA at 10 feet according to UL 464.
 - c. Heat sensor, combination rate-of-rise and fixed temperature.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Smoke detectors utilized for control of smoke dampers shall have an integral, normally-closed set of contacts in the sensor base that open when the smoke detector is in alarm. These contacts shall be utilized to control the power circuit to the smoke damper(s). Alternatively, a separate relay that is controlled by the relay base may be used to control the damper power circuit.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
3. Color shall be white, except provide black only where specifically indicated on the drawings.
4. Spacing shall comply with 2019 NFPA 72 section 17.7.3.2.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:
 - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24VDC nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACU.
4. Duct Smoke Detector Housing: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base (detector housing). The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
5. Weatherproof Duct Smoke Detector Housing: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
7. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
8. Provide a remote test switch with LED indicators where duct smoke detector is not visible from floor. Test station assembly shall include a key switch, red LED alarm indicator and green LED power-on indicator. The test switch assembly shall be mounted on a single gang stainless steel plate for mounting on a single gang outlet box. Test station shall be ceiling mounted or wall mounted at 4'-0" AFF where ceilings are higher than 9'-0"aff, in close proximity to the detector.
9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
10. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
11. Some smoke detector locations, where noted on plan, may require an area type smoke detector without a sampling tube that is installed in the mouth of the return air duct. Carefully coordinate with the HVAC equipment installer.

2.5 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 Deg F or rate-of-rise of temperature that exceeds 15 Deg F per minute, unless otherwise indicated.
 1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACU.

2.6 NOTIFICATION APPLIANCES

- A. Description: Combination devices shall have factory-integrated audible and visible devices in a single-mounting assembly.
- B. Audible Alarm Devices:
 1. Horns:
 - a. Electric-vibrating-polarized type, 24VDC, with horn listed to UL Standard 464.
 - b. Horns shall produce a minimum sound-pressure level of 85 dBA measured 10 feet from the horn.

- c. Rectangular white color housing with red color "FIRE" lettering for surface or semi-flush wall mounting.
- d. Round white color housing with red color "FIRE" lettering for flush mounting on ceiling.

C. Visual Alarm Devices:

1. Strobes:

- a. Xenon strobe lights listed to UL Standard 1971 with clear or nominal white polycarbonate lens mounted on a faceplate. The word "FIRE" shall be provided with minimum 1-inch high letters on the faceplate.
- b. Rated Light Output: Four field selectable 15, 30, 75 or 110 candela strobe settings to be set for value as indicated on the drawings.
- c. Rectangular white color housing with red color "FIRE" lettering for surface or semi-flush wall mounting.
- d. Round white color housing with red color "FIRE" lettering for flush mounting on ceiling.
- e. Strobe Leads: Factory connected to screw terminals.

D. Audible/Visual Alarm Devices:

1. Horn/Strobes:

- a. Horn electric-vibrating-polarized type, 24VDC, with horn listed to UL Standard 464.
- b. Horns shall produce a minimum sound-pressure level of 85 dBA measured 10 feet from the horn.
- c. Rectangular white color housing with red color "FIRE" lettering for surface or semi-flush wall mounting.
- d. Round white color housing with red color "FIRE" lettering for flush mounting on ceiling.
- e. Xenon strobe lights listed to UL Standard 1971.
- f. Rated Light Output: Four field selectable 15, 30, 75 or 110 candela strobe settings to be set for value as indicated on the drawings.
- g. Strobe Leads: Factory connected to screw terminals

2.7 SPRINKLER SYSTEM REMOTE INDICATORS

- A. Remote status and alarm indicator and test stations, with LED indicating lights. Light shall be connected to flash when the associated device is in an alarm or trouble mode. Lamp shall be flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light shall identify, in engraved white letters, device initiating the signal and room where the device is located. For water-flow switches, the identification plate shall also designate protected spaces downstream from the water-flow switch.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units shall be equipped for wall or floor mounting as indicated and shall be complete with matching door plate and any arm extension hardware necessary.
 - 1. Electromagnet: Shall require no more than 3 W to develop 25-lbf holding force.
 - 2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
 - 3. Rating: 24VAC or 24VDC, powered from fire alarm system.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACU for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACU, including acknowledging, silencing, resetting, and testing. Also provide a graphic of the entire building, which indicates the area of the building in which an alarm, trouble or supervisory event has occurred. Each zone on the graphic annunciator shall be no larger than 22,500 square feet.
- B. Mounting: Flush cabinet, NEMA 250, Class 1.
- C. Display Type and Functional Performance: Alphanumeric display same as the FACU. Controls with associated LEDs shall permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACU.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.
- C. Integral Relay: Capable of providing a direct signal to each door lock for power shutdown, unlocking the door.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled according to UL 632, Standard for Electrically-Actuated Transmitters.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from the FACU, and shall automatically capture a telephone line and dial a preset number for a remote central station. When contact is made with the central station(s), the signal shall be transmitted. The unit shall supervise one telephone line. Where supervising a line, if service is interrupted for longer than 45 seconds, the unit shall initiate a local trouble signal and transmit a signal indicating loss of telephone line to the remote alarm receiving station via a digital cellular device (complying with 2019 NFPA-72 26.6.3.1). When telephone service is restored, unit shall automatically report that event to the central station. If

service is lost on the telephone line and digital cellular service is lost, the local trouble signal shall be initiated.

- C. Secondary Power: 24 VDC or integral rechargeable battery and automatic charger. Battery capacity shall be adequate to comply with NFPA 72 requirements.
- D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

- A. Listed and labeled as an integral part of the fire alarm system.

2.13 WIRE AND CABLE

- A. Wire and cable for the fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted shielded pair, not less than size recommended by system manufacturer.
- C. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760. Classification CI, for power-limited fire alarm signal service. Complying with latest UL requirements for a 2-hour rated fire resistive cable. The CI-cable shall be installed in strict conformance with the manufacturer's installation instructions, including limitations on vertical installations between termination points. CI-cables shall be installed in conduit as permitted by the manufacturer.
 - 1. Two-way emergency communication system (area of refuge emergency communication system, area of rescue assistance): NFPA 72 section 24.3.6.9 requires a pathway survivability level 2 or 3. Utilize CI-cables or other methods noted in NFPA 72 section 12.4 to maintain a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 Deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: Minimum No. 16 AWG, unless larger size is recommended.
 - 2. Line-Voltage Circuits: Minimum No. 12 AWG.
 - 3. Multiconductor Armored Cable: NFPA 70 Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe or colored conduit, UL listed for fire alarm and cable tray installation, plenum rated, and complying with latest UL requirements for a 2-hour rating.

2.14 EXTRA MATERIALS

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Lamps for Remote Indicating Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
3. Smoke, Heat and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
5. Manual Pull Stations, and Audible and Visual Notification Appliances: One of each type installed.
6. Keys and Tools: One extra set for access to locked and tamperproofed components.
7. Fuses: Two of each type installed in the system.
8. Input modules and relays: One of each type.

2.15 MONITORING – CENTRAL STATION

- A. Include in bid one (1) year monitoring after substantial completion of the project by a Central Station Monitoring Facility as acceptable by the local authorities having jurisdiction. Provide additional year(s) value to the Owner for extension of the Central Station Monitoring 60 days prior to expiration of agreement provided in the original project.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Smoke or Heat Detector Spacing:
 1. Smooth ceiling spacing shall not exceed 30 feet or the rating of the detector.
 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to NFPA 72.
 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- B. HVAC: Locate detectors not closer than 3 feet from supply-air diffusers and return-air grilles.
- C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- D. Heat Detectors in Elevator Pits, Shafts and Equipment Rooms: Provide fixed temperature rating detectors. Coordinate location with sprinkler head and locate a heat detector within 2'-0" of each sprinkler head.
- E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

- F. Visible & Audible Alarm-Indicating Devices: Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Set visible devices to candela value required by code in the area where the device is installed.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- H. FACU: Surface mount as indicated with tops of cabinets not more than 72" above the finished floor.
- I. Annunciator: Install with top of panel not more than 66" above the finished floor.
- J. Apply sealant around all exterior mounted fire alarm devices to provide weatherproofing and pest control; refer to sections of Division 7.
- K. Install smoke detector at each control panel and NAC location.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method:
 - 1. Provide appropriate multi-conductor fire alarm cables instead of conduit and wire. Cables shall be exposed where above A.C.T. ceilings - provide J-hooks spaced 6'-0" apart down corridor walls, and D-rings spaced 6'-0" apart on structure where cables run from one side of the corridor to the other. Also provide J-hooks in all classrooms, labs, and similar spaces. Where J-hooks and D-rings are not required, cables shall be neatly and properly supported from the structure (not ductwork, piping or conduit) in such a way that they will not be strained as the building settles. Where cables are not above A.C.T. ceilings, provide raceways for cables according to Division 26 raceway requirements. Where cables must pass through partitions (such as floors or walls), provide conduit sleeves sized as required and bushed at both ends - cables are not allowed to poke through partitions. No conduits or sleeves shall be smaller than 1".
 - 2. Cables, raceways, J-hooks, etc. used for fire alarm circuits and equipment control wiring associated with the fire alarm system shall not contain any other wire or cable.
 - 3. Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is permitted where a fire rating is required by NFPA 72, provided UL is currently listing the cable being used.
 - 4. All fire alarm cables shall be plenum-rated.
 - 5. Comply with all requirements of NFPA 72 and NEC Article 760 for wiring methods.
- C. Wiring and Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure

associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Transmitting Device: Provide 1" conduit between the FACU and the transmitter. Install number of conductors and electrical supervision for connecting wiring as required to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26.
- B. Install instructions frame in a location visible from the FACU.
- C. Coordinate all room number designations with the final room numbers. Use final room numbers for all final documentation and display, including but not limited to, programming, alarm displays, annunciator displays, panelboard schedules, signage, labels and engraved labels. The room numbers shall be as directed by the Owner and may not be the same as shown on Contract Drawings. Include final room numbers on the drawings for the Record Documents.

3.4 SPRINKLER SYSTEM CONNECTIONS

- A. See plumbing and sprinkler drawings and specifications for proposed quantities and locations of sprinkler system valves and switches requiring connections to the fire alarm system. The locations and quantities indicated on the electrical drawings are for estimating purposes only. Coordinate final locations and quantity with sprinkler system shop drawings and locations of valves and switches installed. Refer all conflicts to the Architect for resolution.

3.5 GROUNDING

- A. Ground the FACU and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACU.

3.6 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. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Before requesting final approval of the installation, submit a written statement using the form of Record of Completion shown in NFPA 72.
 - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at minimum Level III.
 - 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
 - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - 5. Detectors that are outside their marked sensitivity range shall be replaced.
 - 6. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form.

3.7 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 Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly periods and one quarterly period.
- C. Annual Test and Inspection: One year after date of Substantial Completion, test fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices.
- B. Train Owner's maintenance personnel in the procedures and schedules involved in operating, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours training.
- C. Schedule training with the Owner/Architect at least seven days in advance.

3.9 AS-BUILT DRAWINGS

- A. Provide as-built drawings with conduit pathways, junction box locations and all addressable fire alarm device locations.

END OF SECTION

SECTION 310513
SOIL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subsoil materials.
- B. Topsoil materials.

1.2 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION

- A. VDOT, "Road & Bridge Standards & Specifications," latest edition.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- B. ASTM D698 – Std. Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2487 – Classification of Soils for Engineering Purposes.
- D. ASTM D2922 – Std. Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 – Std. Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 – Std. Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits).

1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures.
- B. Materials Source: Submit name of imported materials source, to Geotechnical Engineer.
- C. Samples: Submit, in air-tight containers, 10 lb (4.5 kg) sample of each type of fill to appropriate testing laboratory.

1.4 QUALITY ASSURANCE

- A. Furnish each individual soil material from single source throughout the work.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- A. Subsoil Type S1:
1. Excavated and re-used material, imported borrow, or select or local borrow.
 2. Graded.
 3. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris; Less than 1% (by weight) of organic matter or other deleterious material.
 4. Existing reused soils fall under USCS Soil Classification MH. Contractor shall follow recommendations found within the Subsurface Geotechnical Report for use.
 5. Existing soils may be used for Detention Basin lining and berm. Refer to the Subsurface Geotechnical Report for recommendations and to paragraph 2.3.B below for testing.
 6. Imported soils for structural fill shall conform to ASTM D2487 Group Symbol CL or better.

2.2 TOPSOIL MATERIALS (See Section 32 91 19 – Landscape Grading for Schedule)

- A. Topsoil Type T1:
1. On-site topsoil, excavated and reused material, conforming to Virginia Stormwater Management Handbook Standard & Spec. C-SSM-02 TOPSOILING.
 2. Graded.
- B. Topsoil Type T2:
1. Imported borrow.
 2. Natural, fertile, friable loamy soil (loam, sandy loam, silty loam, sandy clay loam, or clay loam), of 20-70% sand, 10-60% silt, and 5-30% clay.
 3. Characteristic of productive soils in the vicinity which produce desirable vegetation and obtained from naturally well-drained areas.
 4. Reasonably free of roots, rocks larger than 1 inch (25 mm) in longest dimension, subsoil, debris, large weeds, and foreign matter.
 5. Free of toxic substances or any other material or substance which might be harmful to plant growth or a hindrance to grading maintenance operations.
 6. Acidity range (adjusted pH) of 6.0 to 7.0.
 7. Containing a minimum of 2 percent organic matter.
 8. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 9. With additives as recommended in soil analysis report.

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements: Testing and analysis of soil material.

- B. Testing and Analysis of subsoil material for Detention Basin Berm, Lining, and Core: Coordinate evaluation in the field by project Geotechnical Engineer to determine suitability of onsite soils for berm and core use. Coordinate excavations with locating, testing, and stockpiling suitable material.
- C. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (Standard Proctor) and D2487 (Classification of Soils).
- D. Testing and Analysis of Topsoil Material: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of, inorganic matter (sand, silt, & clay), deleterious material, pH, and mineral and plant nutrient content of topsoil. Report suitability of topsoil for growth of applicable planted material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
- E. If tests indicate materials do not meet specified requirements, change material and retest.
- F. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth.
- B. Remove lumped soil, boulders, and rock.
- C. Stockpile excavated material, suitable for reuse, in area designated on site.
- D. Remove excess material not being used from site.
- E. Remove excavated materials not meeting requirements for reuse from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations indicated on Drawings.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface waters away from stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile topsoil 8 feet (2.5 m) high maximum.

- G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310516
AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Course Aggregate Materials.
 - 2. Fine Aggregate Materials.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS

- A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

AMERICAN SOCIETY OF TESTING AND MATERIALS

- A. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

VIRGINIA DEPARTMENT OF TRANSPORTATION

- E. VDOT "Road & Bridge Standards & Specifications," latest edition.
- F. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.

1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures.
- B. Manufacturer's Certificate: Submit name of imported materials suppliers to Geotechnical Engineer.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from a single source throughout the work.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1 (Utility Bedding, Haunching, & Initial Cover): Conforming to VDOT Std. #68, 7, or 78.
- B. Coarse Aggregate Type A2 (Drainage Fill): Conforming to VDOT Std. #57.
- C. Coarse Aggregate Type A3 (Base for Concrete Flatwork): Conforming to VDOT Std. #5, 56, or 57.
- D. Coarse Aggregate Type A4 (Aggregate Base under Pavement and Curbing): Conforming to VDOT Std. #21A or B, Type II (A or B as indicated in pavement sections on the Drawings).
- E. Fine Aggregate Type A5 (Sand for Bedding): Conforming to VDOT Std. Grade "C" Fine Aggregate, VDOT Std. #10 Course Aggregate, or equivalent. A minimum of 100% (by weight) must pass a 3/8" laboratory square opening sieve, 94-100% passing a No. 4 sieve, and a maximum of 25% (by weight) may pass a No. 50 sieve.
- F. Course Aggregate "Rip-Rap" (as referenced on plans by d50 value): A well graded rip-rap, in accordance with DEQ and VDOT standards, consisting of field stone of approximately rectangular shape. Specific gravity of individual stones shall be 2.5 minimum. Mean stone diameter shall be as denoted by the "d50" value. The diameter of the largest stone size shall not be larger than 1.5 times the d50 size. The diameter of the smallest stone size shall not be smaller than 0.3 times the d50 size. Small fines will not be permitted.
- G. Course Aggregate "Landscape Stone": 2" to 4" median stone size river rock; brown/tan/white equal mix, washed, unbroken.

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Source testing and analysis of aggregate material.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. If tests indicate materials do not meet specified requirements, change material or material source and retest.
- D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 STOCKPILING

- A. Stockpile in sufficient quantities to meet Project schedule and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site so as to prevent deterioration of materials.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.
- B. If a borrow area is utilized, leave area in a clean, neat, and stabilized condition. Grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 310900
GEOTECHNICAL ENGINEERING, INSPECTION AND TESTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Geotechnical investigation report.
- B. Earthwork quality assurance.
- C. Underground utility quality assurance.

1.2 GEOTECHNICAL INVESTIGATION REPORT

- A. A geotechnical investigation report has been prepared for the site of this work by an independent geotechnical engineer.
- B. A copy of the full geotechnical investigation report for this project is bound at the end of the Project Manual in the Appendix.
- C. This geotechnical investigation report was obtained only for the Architect's/ Engineer's use in design and is not a part of the Contract Documents unless specifically referenced.
- D. The report is provided for bidder's information but is not a warranty of subsurface conditions. Owner assumes no responsibility for conditions of site or continuation of those conditions existing at the time of report generation.
- E. Bidders should visit the site and acquaint themselves with existing conditions.
- F. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Architect.

1.3 EARTHWORK QUALITY ASSURANCE

- A. A qualified independent Soils Testing Laboratory, which staffs a Professional Geotechnical Engineer, registered in Virginia (herein after Geotechnical Engineer), will be retained by the Owner to observe and report performance or work in connection with Rough Grading, Excavating, Backfill, & Trenching , and any other earthwork related concern.
- B. The Geotechnical Engineer shall perform the following:
 - 1. Make a site inspection, review governing requirements for this work and the test results and make recommendations on applicable portions of the Work (traffic bearing areas, building foundation, detention basin lining and berm, etc., as may be applicable to this project),
 - 2. All required tests to determine bearing capacity of soil (subgrade suitability)

prior to placement of all footings, slabs, tanks, utilities, and constructing the detention basin, etc.

3. Inspections,
 4. Testing of all proof-rolling and filling operations,
 5. Determination of materials (suitable, unsuitable, rock, etc., as may be applicable to this project),
 6. Quantify materials involving unit price payments as applicable,
 7. Submit certifications of all such tests and inspections as may be herein required, with a proper description of tested or inspected locations, to the Architect/Engineer with a copy to the Contractor. Location maps shall be submitted with each report identifying areas where testing occurred.
- C. All testing performed by the Geotechnical Engineer is solely in the interest of and for the protection of the Owner.
- D. The density of all finally placed or excavated material shall be as specified herein and as determined suitable by the Geotechnical Engineer.
- E. The Contractor shall be responsible for notifying the Geotechnical Engineer of his readiness for all tests in a timely manner and for providing access to the site so as to cause no delay to the project.
- F. All instructions and directions provided by the Geotechnical Engineer to the Contractor shall be in writing and immediately communicated to the Owner and Architect.
- G. When a soils test requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-testing required shall be borne by the Contractor.
- H. Notwithstanding any tests, instructions, or decisions made by the Geotechnical Engineer, the Contractor shall not be relieved of his obligation to perform all grading and compaction work in accordance with the Contract Documents.
- I. The Contractor may, at his option, hire his own Soils Testing Service to assure himself that his work is in accordance with the Contract Documents.

1.4 UNDERGROUND UTILITY QUALITY ASSURANCE

- A. The Owner or owner's designated representative, will observe and report performance on work in connection with Underground Utility installation and testing.
- B. The Owner or Owner's Representative may perform the following:
1. Review governing requirements for installation of this work,
 2. Upon accepting condition of trench for pipe installation, observe placement of bedding, haunching, pipe, any anchorage or thrust blocking required, and initial cover to assure that pipe is installed in accordance with those requirements,
 3. Verification of appropriate pipe, joint, and fitting materials,
 4. Observation of all required tests to determine suitability of said pipe

- installation, and
5. Submit certifications of all such inspections and observations as may be herein required, with a proper description of tested locations, to the Architect/Engineer with a copy to the Contractor.
- C. All utility related work performed during inspection is solely in the interest of and for the protection of the Owner.
- D. The Contractor shall be responsible for notifying the Owner of his readiness for all inspections and observations in a timely manner and for providing access to the site so as to cause no delay to the project.
- E. Approvals and Disapprovals provided by the Owner's Representative to the Contractor shall be in writing and immediately communicated to the Owner and Architect/Engineer.
- F. When an inspection/observation requested by the Contractor fails to meet the requirements of these specifications, the cost of all re-inspection/observation required shall be borne by the Contractor.
- G. Notwithstanding any tests, instructions, or decisions made by the Owner's Representative, the Contractor shall not be relieved of his obligation to perform all utility work in accordance with the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 311000
SITE PREPARATION AND CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation.
- B. Protection: Protect improvements and vegetation to remain within and beyond/outside limits of disturbance.
 - 1. Barriers, warnings, shoring, etc.
 - 2. Adjacent properties, waterways and the air
 - 3. Reference points,
 - 4. Existing improvements,
 - 5. Existing utilities, and
 - 6. Trees and vegetation.
- C. Demolition, Clearing & Grubbing:
 - 1. Remove surface debris.
 - 2. Demolish and remove existing site improvements. Designated paving and curbs.
 - 3. Clear site of plant life and grass.
 - 4. Remove trees and shrubs, including root systems, unless designated to remain.
- D. Topsoil Stripping: Excavate and stockpile topsoil.
- E. Removal: Clean up, remove and dispose of undesirable material off-site.
- F. Restoration: Restore existing finished surfaces disturbed to that of proposed finishes (preconstruction condition as a minimum).
- G. Utility Adjustments: Adjust new and existing utility tops to meet proposed finish grades.
- H. Definitions.
- I. Project Record Documents.

1.2 REFERENCES

- A. Virginia Stormwater Management Handbook, latest edition: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Health (VDH) "Waterworks Regulations", latest edition: Well or Monitoring Well abandonment.
- C. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications", latest edition: Safety Items.

- D. Manual on Uniform Traffic Control Devices (MUTCD), latest edition (including the Virginia Supplement): Pavement Marking and Signage within right-of-way.

1.3 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. These include but shall not be limited to those pertaining to erosion and sediment control and disposal of debris.
- B. Obtain all required permits from authorities having jurisdiction.
- C. Erosion & Sediment Control (ESC): See Section 31 25 13 - Erosion & Sediment Control for plan preparation, review, approvals, regulatory requirements, etc.
- D. Utility Companies: Administrative Requirements: Coordination & Meetings: Coordinate clearing Work with utility companies. Verify locations of existing utilities. Notify them prior to starting and comply with their requirements.
- E. Existing Signage within Right-of-Way: Any existing signs shall be relocated as necessary meeting all state and local ordinances including conformance in design and placement with the Virginia Supplement to the Manual on Uniform Traffic Control Devices (MUTCD), latest edition. Edge of signs shall be 12 feet off edge of pavement or 6 feet off shoulder or 2 feet behind face of curb. Clear height shall be 7 feet above grade. Reference document shall take precedence.

1.4 DEFINITIONS

- A. Limit of Disturbance or Construction Limits: The extent that proposed contours, erosion and sedimentation control measures, subsurface utility work and surface improvements are indicated on the Drawings or as delineated as limits on Drawings plus Contractor trailer, storage and parking as defined in the Contract Documents.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of utilities to remain, by horizontal dimensions from landmarks to remain, depth or elevations of inverts, and slope gradients while preparing for land disturbance and in providing protection of utilities.
- B. Provide an as-built electronic survey of improvements including detailed location information for the detention basin, all storm structure tops and invert elevations as well as outfall structure (orifices) elevations.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Erosion and Sediment Control Materials: See Section 31 25 13 - Erosion and Sediment Control for approved materials and products.

- B. See Section 31 05 13 – Soil Materials: Definitions of subsoil and topsoil materials.

PART 3 EXECUTION

3.1 PREPARATION

- A. Accept premises as found. Owner assumes no responsibility for conditions of site or continuation of conditions existing at time of advertisement.
- B. Assure that all pertinent required permits have been obtained.
- C. Verify all site conditions pertinent to this work. In particular – coordinate the newly installed sanitary sewer manhole invert elevation with lower level building plumbing.
- D. Locate, identify and flag/mark for protection all bench marks, property corners and reference points. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Contractor shall lay out all work and be responsible for all lines, elevations and measurements.
- F. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.
- G. Drawings do not purport to show all objects existing on the site. Before commencing work, verify with the Architect all improvements to be protected, salvaged, relocated, removed or demolished. Existing utilities are indicated on the Drawings in accordance with available records.
- H. Before any work is started, the Contractor shall contact all corporations, companies, individuals and local authorities owning, maintaining or regulating utilities, conduits, wires and pipes running to or on the property to make suitable arrangements for locating, protection, handling, relocation, adjusting, and/or removal and disposal/salvage of such lines or structures. Verify locations and elevations.
- I. Contact MISS UTILITY at least 48 hours in advance of land disturbing activities. Contractor shall be responsible for hiring private utility locators for any area MISS UTILITY will not locate on the property.
- J. Before any work is started, the Contractor shall contact all state and local authorities owning, maintaining or regulating adjacent rights-of-way to make suitable arrangements for protection, handling, relocation, and/or removal and disposal/salvage of such improvements involved in this Work (signs, structures, etc.). Verify locations, elevations and applicable codes.

3.2 PROTECTION

- A. General: Erect and maintain temporary bracing, shoring, lights, barricades,

warning signs, etc., all in accordance with applicable rules and regulations.

- B. Protection of adjacent properties, waterways and the air:
 - 1. Prior to any land disturbance activity install Erosion and Sediment Control measures conforming to Section 31 25 13 - Erosion and Sediment Control (ESC). See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
 - 2. Clearing shall be restricted to the area within the right-of-way, easements, and Construction Limits indicated on the Drawings.
 - 3. Any material which will result in dust shall be wet down during removal.
- C. Protection of Reference Points: Protect and maintain all bench marks, property corners, monuments and other reference points from damage or displacement. Do not cover. Obtain accurate replacement of any that is disturbed, destroyed or moved due to the work and furnish a certificate by a professional civil engineer or land surveyor that all such items have been relocated accurately.
- D. Protection of Existing Improvements:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, utilities, and other adjacent improvements to remain. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction and prior approval by the Owner.
 - 2. Use all means necessary to protect existing improvements designated to remain. In the event of damage, immediately make all necessary repairs and replacements as directed by the Architect.
- E. Protection of Existing Utilities:
 - 1. Existing utilities, encompassing all water systems, storm and sanitary sewer systems, gas lines, electric systems, telephone and communication systems, underground storage tanks, etc., and all accessories thereto, underground, on the surface or overhead, located in or affected by the construction of the work shall be relocated as required
 - 2. Protect existing utilities noted to remain.
 - 3. Coordinate the timing of utility adjustments to ensure that all new and existing utility tops are adjusted to proposed finish grades prior to stone base applications in paved areas, and prior to topsoil applications within lawn spaces.
 - 4. Give advance notice to the Utility Owner of work to be removed or relocated. The work shall be performed by the Contractor or Utility Owner with arrangements and payment for this work being made by the Contractor.
 - 5. If existing concealed utilities not shown or correctly indicated by the Contract Documents are encountered, the Contractor shall stop work in that area and notify the Architect and Utility Owner. Do not proceed until written instructions are received from the Architect.
 - 6. The Contractor shall excavate with care to determine the exact location of existing utilities, including sizes and inverts. Also, stake and flag at this

time for protection. This work shall precede pipe laying, grading, excavation and other construction as far as practicable, to permit adjustments where required.

- F. Protection of Existing Trees and Vegetation:
 - 1. Contractor shall assume that all existing vegetation on the premises is intended to remain unless specifically noted otherwise.
 - 2. Protect existing trees, plant growth, and features against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark, or damage from dust, debris, or chemicals. Conform to details and specifications of the Stormwater Management Handbook for methods of protection.
 - 3. Disposal of any adhesives, concrete, plaster, paints, thinners, or other volatile liquids or substances detrimental to vegetation shall be done in proper locations away from existing or new plant materials.
 - 4. Repair or replace trees and vegetation damaged by construction operations, but not intended for demolition, in a manner acceptable to the Architect

3.3 DEMOLITION, CLEARING AND GRUBBING

- A. Removal of utilities may cause excavations beneath proposed buildings and improvements. All excavations performed for demolition purposes shall be backfilled and tested in accordance with the specifications.
- B. Clear areas required for access to site and execution of Work. Honor described or indicated Limits of Construction and Disturbance.
- C. Remove existing walks, pavement, fencing, curbs, minor buildings and structures where required for excavation or new construction or as indicated on the Site Drawings. Existing pavement to be removed or connected to shall be neatly cut in straight lines at necessary locations required to accomplish required work. Existing pavement to be trenched through by the open cut method shall be neatly cut in straight lines at minimum width required to accomplish required work.
- D. Where asphalt or concrete walks or pavement are removed in locations proposed as lawn or planting beds, all existing bedding stone shall be removed. Underlying subsoil shall be loosened and prepared to receive fill, topsoil, or mulch as applicable.
- E. Upon encountering and well within limits of disturbance, verify first with A/E that well is not in use and that Owner desires it to be formally abandoned. If so desired Contract price will be adjusted by Change Order. Abandon well in accordance with Virginia Department of Health "Waterworks Regulations", Section 3.8 - Observation, Monitoring and Remediation Wells and Section 3.11 - Well Abandonment. Adjust top elevation of casing as required to maintain three (3) feet of cover from finished grade.
- F. Abandon in place, in accordance with applicable codes, all utility lines, septic

tanks, drain fields, septic pits, dry wells, etc., not intended to remain, if it poses no conflict with the Work, will have three (3) feet of cover at finished grade and, in the opinion of the Architect, remaining in place does not have an adverse impact upon the project or intended use.

- G. Remove utility lines & structures, septic tanks, drain fields, septic pits, dry wells, etc., which conflict with the work, do not meet the preceding conditions, or are specifically noted for removal. Provide for the relocation, raising or lowering of existing electric and telephone poles where required.
- H. Remove grass, trees, stumps, shrubs, roots, vines, weeds, brush, surface rocks, debris and all other extraneous material or objects from areas to be built upon or graded. Remove all vegetation to a sufficient depth to prevent regrowth.
- I. Conduct demolition, clearing and grubbing operations in such a manner as to minimize disturbance to subsoil and creation of dust. Remove existing foundation walls, floor slabs and footings in such a manner as to avoid disturbing underlying subgrade.
- J. Where trees are indicated to be left standing, stop topsoil stripping at drip line to prevent damage to main root system. Use only hand grubbing inside the driplines of trees to remain.
- K. Fill depressions caused by demolition, clearing and grubbing operations with controlled fill unless further excavation or grading is indicated and immediately follows.
- L. Do not allow water to pond in any excavation or depression. See Dewatering in Division 01: Temporary Controls.

3.4 STRIPPING TOPSOIL

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded as indicated on the Drawings. Excavate to whatever depths encountered in a manner to prevent intermingling with underlying sub-soil or other objectionable material. Comply with the following:
 - 1. Do not excavate wet topsoil.
 - 2. Avoid including debris, stones and other extraneous matter in topsoil which will make it "unsuitable" under Section 31 05 13 – Soil Materials: Topsoil Materials.
 - 3. Leave subsoil surface free of trash, debris and foreign materials.
- B. Stockpile on site in an area approved by the Architect/Engineer. Comply with Section 31 25 13 - Erosion & Sediment Control; Topsoil Stockpile.

3.5 CLEANUP, REMOVAL & DISPOSAL

- A. Clean up debris resulting from site clearing and grading operations (earthwork related) continuously with the progress of the Work.

- B. Remove debris, rock, extracted plant life, unsatisfactory, and/or surplus (not being reused) soil materials, etc. from site.
- C. Any debris, rock, extracted plant life, etc. designated to be removed from the site shall become the property of the Contractor and shall be disposed at the Contractor's expense.
- D. Dispose of all material in accordance with all local, state and federal regulations governing same.

END OF SECTION

SECTION 312213
ROUGH GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site Subgrade Contouring. General cutting, grading, filling, and rough contouring of the site for access drives, parking, site structures, building pads, landscaping features, etc., as applicable.
- B. Furnish all labor, materials, equipment, and incidentals necessary for earthmoving, grading, cutting, filling, and compaction to provide subgrade elevations as specified herein from finish grades indicated on the Drawings.
- C. Unauthorized excavation defined.

1.2 REFERENCES

AMERICAN SOCIETY OF TESTING & MATERIALS

- A. ASTM C136 - Method For Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- E. ASTM D2419 - Test Method For Sand Equivalent Value of Soils and Fine Aggregate.
- F. ASTM D2434 - Test Method For Permeability of Granular Soils (Constant Head).
- G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 DEFINITIONS

- A. "Finish grade" refers to contours and spot grades indicated on the Drawings.
- B. "Subgrade" or "rough grade" refers to bottom of footings at foundation walls and columns, bottom of aggregate fill within trenches or under slabs-on-grade and

paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. "Subgrade" may also refer to the subsoil base upon which fill is to be placed

- C. "Unsuitable material" refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

1.4 CLASSIFICATION OF EXCAVATION

- A. All cutting, filling, excavating and backfilling to the limits of rough grade as defined herein is "unclassified" except for unsuitable soil, mass rock, and trench rock (as defined) and it shall be the Contractor's responsibility to determine the subsurface character. Bidders are expected to examine the site and then decide for themselves the character of materials to be encountered. Claims for extra compensation arising from latent, subsurface conditions within the area defined will not be considered.
- B. Excavation beyond the indicated subgrade elevations or excavation side dimensions shall be replaced at Contractor's expense with material per schedule this section.

1.5 SUBGRADE SUITABILITY

- A. The Geotechnical Engineer shall inspect all subgrades below footings and below slabs on grade and the results of such inspections shall be reported to the Architect and Owner.
- B. As determined by the Geotechnical Engineer, any unsuitable material below limits of subgrade elevations shall be removed and replaced per schedule this section. Contract Price will be adjusted by Change Order except as indicated in "C" below.
- C. Once any subgrade has been approved by the Geotechnical Engineer for pouring of footings, slabs, etc., if the pouring of concrete is delayed by the Contractor, for any reason, resulting in subsequent disapproval of said subgrade by the Geotechnical Engineer, any additional excavation required as a result of such subsequent disapproval shall be provided by the Contractor at no additional cost to the Owner.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Type T1 or T2 as specified in Section 31 05 13.
- B. Subsoil Fill: Type S1 as specified in Section 31 05 13.

- C. Structural Fill: Type S1 as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 30 00 – Administrative Requirements: Coordination.
- B. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION, PROTECTION, & CLEANUP

- A. Control water in accordance with Division 01 – Temporary Controls. Ponding water will not be permitted.
- B. Comply with Section 31 10 00 - Site Preparation & Clearing: Preparation, Protection, Field Measurements, Cleanup.
- C. The Contractor shall be responsible for controlling on-site construction traffic to prevent softening or rutting of completed controlled fill work. Additional work required due to improper traffic control will be at the Contractor's expense.
- D. Identify required lines, levels, contours, and datum.
- E. Locate, identify, and protect above and below grade utilities that remain, from damage.
- F. Notify utility company to remove and/or relocate utilities, as applicable.
- G. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- H. Protect bench marks, survey control points, any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 PROOF-ROLLING

- A. After all demolition, clearing, grubbing, and topsoil and organics stripping the exposed subgrade shall be proof-rolled. Proof-rolling shall be with a tandem axle dump truck or similar pneumatic tired equipment weighing at least 10 tons (20 tons max) to locate soft or other unsuitable areas. The number and direction of passes shall be as required by the Geotechnical Engineer.
- B. Any soft or compressible areas or unsuitable material encountered shall be removed and replaced per schedule this section. The Geotechnical Engineer shall observe the removal, document the volume, observe and test the replacement and immediately forward copies of documentation to the Architect/Engineer.

- C. Unless approved by the Geotechnical Engineer proof-rolling shall be a continuous operation until the entire site is complete.
- D. When extensive excavation is required to bring the site to rough grade, proof-rolling shall occur simultaneously with the excavation work, if possible.
- E. The Contractor shall provide assistance to the Geotechnical Engineer or his representative as required to accomplish this work and to accurately track the progress of proof-rolling.
- F. After proof-rolling the subgrade, areas to receive fill shall be uniformly scarified to a depth of 2". Water shall be added to the loosened material or it shall be allowed to dry as required so that the moisture content is within necessary limits of the optimum as judged or tested by the Geotechnical Engineer.

3.4 SUBSOIL EXCAVATION (Cutting)

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Work within 15 feet of any structure to remain shall be handled under Section 31 23 16 – Excavating. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.
- C. Do not excavate wet subsoil unless determined to be "unsuitable material".
- D. When excavating through roots of trees to remain, perform work by hand and cut roots with sharp ax.
- E. If rock is encountered, it shall be excavated to 6" below rough grade and replaced per schedule this section.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 STOCKPILING

- A. Stockpile suitable excavated material per Section 31 25 13 - Erosion & Sediment Control: Topsoil/Soil Materials Stockpile.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements. Stockpile materials on site at locations acceptable to Architect/Engineer. Avoid drainage ways and drip areas of trees. Remove excess material and material unsuitable for reuse as fill from site.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.

3.6 FILLING

- A. Before fill is placed, existing grade shall be prepared as specified in Section 31 10 00, shall be dry and clean of all debris, and shall be proof-rolled in accordance with this section.
- B. Scarify proof-rolled, existing subgrade to a depth of 2" prior to placing fill.
- C. All fill materials shall be tested and approved by the Geotechnical Engineer prior to placement and shall meet or exceed the requirements as specified in schedule this section.
- D. Place fill to subgrade contours and elevations allowing for later placement of topsoil and pavements.
- E. Furnish additional fill material from off site if required to complete the work. Fill material from off-site is subject to approval of the Architect and Geotechnical Engineer.
- F. Filling operations for embankments having a slope greater than 1' vertically to 4' horizontally or other similar areas noted on the site plan shall be stepped or benched in 8" vertical lifts. Carry fill slope at least three feet horizontally beyond design rough grade, then cut back to well compacted material at subgrade elevations indicated on the Drawings.
- G. Do not place fill in water or mud or on frozen or frosty ground.
- H. Surfaces of new grades shall be left clean and ready to receive applicable finished surface. Remove all ruts and depressions to give a smooth and uniform subgrade.
- I. To avoid delay of the project, when wet weather will not permit placement of soil fill material under the building area, Contractor will be permitted the option of using structural fill type A3 or as acceptable to the Geotechnical Engineer, as the fill material at no additional cost to the Owner.
- J. Fill areas to contours and elevations with unfrozen materials.
- K. Place fill material on continuous layers and compact in accordance with the schedule at end of this section.
- L. Maintain optimum moisture content of fill materials to attain required compaction density.
- M. Slope grade away from building minimum 2 inches in 10 ft (1.5:100), unless noted otherwise. This is also the minimum for grassed areas.
- N. Make grade changes gradual. Blend slope into level areas.
- O. Remove surplus fill materials from site.

3.7 RESTORATION OF GRADES

- A. Restore to original grades and conditions all properties damaged by any activity related to this work and take adequate precautions to avoid settlements or cave-ins of properties higher than site, and settling, eroding or other damage to properties lower than site.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3.8 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as Detention Basin Berm); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.9 COMPACTION OF FILLS

- A. Required compaction tests shall be carried out according to ASTM D698 Standard Proctor Test by the Geotechnical Engineer.
- B. Field testing methods shall be as determined by the Geotechnical Engineer.
- C. Contractor shall be responsible for notifying Geotechnical Engineer as each lift is installed. Contractor shall not place additional lifts until tests indicate the fill is compacted to specified densities. Should any lifts be placed prior to approval of lower lifts, the work shall be removed at no additional cost to the Owner.
- D. Materials and densities shall be in accordance with schedule this section.
- E. The moisture content of the fill material shall be within +2% to -3% of the optimum range for maximum compaction during compaction. Add water as required. If excess water exists, it shall be reduced by harrowing, dicing and natural evaporating.

3.10 FIELD QUALITY CONTROL

- A. Testing: In accordance with ASTM D698.
- B. Work performed which does not meet technical or design requirements as determined by the Geotechnical Engineer will be removed, replaced and retested at no additional cost to the Owner. No deviations from the Contract Documents shall be permitted without specific and written approval from the Architect/Engineer.

- C. Thickness of lifts prior to compaction and distribution of tests, unless otherwise required by the Geotechnical Engineer, shall be accordance with the following table:

<u>AREA</u>	<u>MAX. LIFT THICKNESS</u>	<u>TEST DISTRIBUTION (PER LIFT)</u>
Lawn & unpaved areas	8"	1 per 10,000 s.f.
Backfills (Exterior)	8"	1 per 2,500 s.f.
Embankments (3H:1V & >)	8"	1 per 3,000 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 2,000 s.f.

- D. Lift thickness given are for heavy compaction equipment. If hand operated equipment is used then lift thickness shall be one-half of those given above.
- E. Test distributions are minimum requirements with more required if deemed necessary by the Geotechnical Engineer. If fill area is linear in shape and less than 50' wide, provide one (1) test per 50 linear feet of the fill areas.
- F. Density requirements under slabs, footings and pavement shall be carried ten feet (10') beyond exterior edges.

3.11 STOCKPILE CLEANUP

- A. Comply with Section 32 91 19 - Landscape Grading for finish grading and preparation of stockpile areas for landscaping/seeding.
- B. Comply with state and local erosion and sediment control ordinances by having stabilized all disturbed areas at completion of work.

3.12 SCHEDULES

- A. Fill Under Slab-On-Grade Building to 10 Feet Outside:
1. Fill Type S1, to subgrade elevation, compacted to 98 percent,
 2. Inside foundation wall cover with Fill Type A3 (Base for Concrete Flatwork), 4 inches (100 mm) thick (unless detailed otherwise), compacted to 95 percent.
- B. Fill Under Grass Areas:
1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent. See Section 32 91 19 - Landscape Grading for topsoil depth.
- C. Fill Under Landscaped Areas:
1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 90 percent.
- D. Fill For Landscape Berms:

1. Fill Type S1, to specified depth of topsoil below finish grade, compacted to 85 percent.
- E. Fill Under Vehicular Asphalt or Concrete Paving, Pavers, Curbs and Concrete Dumpster Pads:
1. Compact subsoil to 95 percent of its maximum dry density.
 2. Fill Type S1, to within one (1) foot of pavement subgrade, compacted to 98 percent.
 3. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 98 percent.
- F. Fill Under Non-Vehicular Concrete Paving or Pavers (Walks):
1. Compact subsoil to 95 percent of its maximum dry density.
 2. Fill Type S1, to pavement subgrade as indicated in applicable pavement section or schedule description, compacted to 95 percent.
- G. Fill to Correct Over-excavation:
1. Fill Type A1, flush to subgrade elevation, compacted to 95 percent.
- H. Fill Over-Excavation of Demolished or Grubbed Material:
1. Under Grassed Areas: Fill Type S1, to specified depth of topsoil below finish grade, compacted to 95 percent. See Section 32 91 19 - Landscape Grading for topsoil depth.
 2. Under other improvements: Same as fill to Correct Over-Excavation or for specified surface.
- I. Topsoil Fill: See Section 32 91 19 - Landscape Grading.

END OF SECTION

SECTION 312316
EXCAVATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for building foundations.
- B. Excavating for slabs-on-grade, curbing, walks, landscaping, etc.
- C. Excavating for site structures.

1.2 DEFINITIONS

- A. Finish grade refers to contours and spot grades indicated on the Drawings.
- B. Subgrade or rough grade refers to bottom of footings at foundation walls and columns, bottom of crushed stone fill within trenches or under slabs-on-grade and paving, and finish grade less specified topsoil depth elsewhere. Refer to applicable Drawings and Schedules for distances below finish grade. Subgrade may also refer to the subsoil base upon which fill is to be placed.
- C. Where rock is encountered, Contractor shall over-excavate 6 inches below defined subgrade.
- D. Unsuitable material refers to any material beneath proposed subgrade in cut conditions and existing subgrade in fill conditions, which in the opinion of the Geotechnical Engineer, after observing proof-rolling or other testing/observation, will not be a satisfactory base for supporting the proposed work above.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

- A. Underpin adjacent structures which may be damaged by excavating work.
- B. Work within 15 feet of any structure to remain shall be handled under Excavation. Should the Architect or Geotechnical Engineer determine the structure to be in jeopardy by grading operations this distance may be increased.

- C. Excavate subsoil to accommodate building foundations, slabs-on-grade, curbing, and site structures, construction operations, etc.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation. Hand trim excavation. Remove loose matter.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Do not excavate wet subsoil unless authorized as "unsuitable material".
- J. When excavating through roots, perform work by hand and cut roots with sharp ax.

3.3 TOLERANCES

- A. Bottom of Footings: Excavate in excess of required dimension on detail from true line and grade.
- B. Sides of Footings: Excavate in excess of required dimension on detail from centerline of true alignment.
- C. Excavation for Misc. Structures: Plus or minus 0.04 foot (0.5 in) (13 mm) from true line and grade.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Assurance: Field inspection and testing. Geotechnical Engineer.
- B. Prevent soil in excavated areas previously considered suitable from becoming "unsuitable" due to rainfall or surface runoff and ponding. Measures to protect subgrade shall include, but not be limited to, delaying final excavation of bottom 8" of material to just prior to finished product placement, or installing a protective layer of lean concrete.
- C. Provide for visual inspection of bearing surfaces. Place no footing until soil bearing capacity has been verified by the Geotechnical Engineer.

3.5 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 312317
UTILITY TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES (But is not limited to)

- A. Excavating trenches for utilities from inlets to indicated points of connection to municipal utilities, source, outfall, etc., as applicable.
- B. Compacted backfill from top of utility cover bedding/initial backfill to subgrade elevations.

1.2 REFERENCES

- A. VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- B. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Bedding: Fill placed under pipe to provide support.
- C. Haunching: Fill placed from bedding to spring line of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- D. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.4 FIELD MEASUREMENTS

- A. Verify that survey bench mark, control point, and intended elevations for the Work are as shown on the Drawings.

1.5 COORDINATION

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record on Project Record Documents the actual locations of existing utilities encountered, by horizontal dimensions, elevations or inverts, and general direction.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Backfill: Type S1 as specified in Section 31 05 13 – Soil Materials.
- B. Coarse Aggregate (Utility Bedding): Type A1 as specified in Section 31 05 16 - Aggregate Materials.
- C. Flowable Backfill: As specified in VDOT "Special Provision for Flowable Backfill" dated March 11, 2010.
- D. Concrete: Lean concrete with a compressive strength of 1,000 psi (7 MPa).

2.2 ACCESSORIES

- A. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape or manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously over entire tape length. Warning and identification shall be "CAUTION BURIED WATER LINE/SANITARY SEWER/STORM SEWER BELOW" or similar, as applicable. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.
- B. Should Local Governing Authority require separate Detection Wire and Warning/ Identification Tape, meet the local requirements regarding materials, function, and placement.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Miss Utility.
- C. Protect plant life, lawns and other features remaining as a portion of final landscaping.
- D. Protect bench marks, and any existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

- E. Maintain and protect above and below grade utilities which are to remain.

3.2 EXCAVATING

- A. Excavate subsoil required for utilities from origin to destination as indicated.
- B. Cut trenches sufficiently wide to enable safe installation and allow inspection. Remove water or materials that interfere with Work.
- C. Install trench forms of sufficient height and minimum width to reduce the amount of lateral excavation. Portions of excavations may approach adjacent property lines, pins, landscaping and tree root systems which shall be protected.
- D. Do not interfere with 45 degree bearing splay of foundations or as otherwise indicated by Geotechnical Engineer in Soils Report or from their field inspection.
- E. Hand trim excavation, including joints, as necessary. Remove loose matter.
- F. Remove any lumped subsoil, large stones, or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- G. Cut out soft areas of subgrade not capable of compaction in place. See Section 31 22 13 – Rough Grading for Subgrade Suitability. Backfill per schedule this section.
- H. Correct areas over-excavated in accordance with Section 31 22 13 – Rough Grading.
- I. Stockpile excavated material, if suitable for use and required for rough grading, in area designated on site, and remove excess material from site.

3.3 BEDDING & HAUNCHING

- A. Place Geotextile fabric, if applicable, as indicated in details in coordination with appropriate lifts of fill.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place bedding and haunching to spring line of pipe and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

3.4 BACKFILLING

- A. Backfill trenches with unfrozen fill materials per applicable utility trench section to proposed subgrade per finished contours and elevations allowing for topsoil or pavement as applicable.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Backfill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

- D. Employ a placement method that does not disturb or damage utilities in trench or any adjacent work.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Place Buried Utility Warning and Identification Tape continuous over each separate run of piping. Bury tape with printed side up and at the location indicated in the trench sections on the Drawings.
- G. Remove surplus fill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials and restore to applicable proposed finished surface condition.

3.5 COMPACTING

- A. Percentage of maximum density requirements:
 - 1. Compact virgin subsoil (bottom of excavated trench) and each layer of backfill due to over-excavation to 95 percent of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).
 - 2. Compact each layer of backfill to not less than the scheduled percentages of maximum dry density at +/-3% optimum moisture content as determined by ASTM D698 (Standard Proctor).
- B. Equipment: Use power-driven hand tampers for compacting materials adjacent to structures and in trenches. Provide equipment capable of adding moisture to the soil material or for aerating the soil as determined necessary by moisture-density tests.
- C. Moisture Conditioning: Uniformly apply water in such a manner as to prevent free water appearing on the surface, either during or subsequent to compaction operations. Compaction by flooding is prohibited.
- D. Re-fill, re-grade and re-finish any area that becomes unsatisfactory due to freeze-thaw, erosion or settling. All areas or portions thereof that do not meet minimum density requirements shall be reworked and compacted until they meet the project density requirements.

3.6 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1-1/2 inches (0.12 ft) (37 mm) from required elevations.
- B. This tolerance shall not relieve the Contractor from providing minimum sections of finish surfaces or meeting critical spot grades shown on drawings.

3.7 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ASTM D698 (Standard

Proctor) and ASTM D3017 (Moisture Content).

- B. Field testing methods shall be as deemed appropriate by the Project Geotechnical Engineer.
- C. Request inspection prior to and immediately after placing bedding.
- D. Frequency of Compaction Tests: One per lift per 200 LF of trench or fraction thereof.
- E. If tests indicate Work does not meet specified requirements, remove unacceptable Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

- A. Re-fill, re-grade and re-stabilize any area that becomes unsatisfactory due to freeze-thaw, erosion or settling, or vehicular traffic during construction.

3.9 SCHEDULE: See applicable trench sections on Drawings.

- A. Backfill Under Asphalt Pavement, Concrete Flatwork, and Road Shoulders:
 - 1. To pavement subgrade, compacted to 100 percent.
- B. Backfill Through Embankments Under Grass Areas:
 - 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 32 91 19 - Landscape Grading.
- C. Backfill Under Grass:
 - 1. To specified depth of topsoil below finish grade, compacted to 90 percent.
See Section 32 91 19 - Landscape Grading.
- D. Backfill Under Landscaped Areas:
 - 1. To 12 inches (300 mm) below finish grade, compacted to 90 percent.
- E. Backfill to Correct Over-excavation:
 - 1. Flush to required subgrade elevation, compacted to 95 percent. On a case by case basis, as approved by the Engineer, lean concrete to minimum compressive strength of 1000 psi (7 MPa) may be allowed.

END OF SECTION

SECTION 312318
ROCK REMOVAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of identified and discovered rock during excavation.
- B. Expansive tools to assist rock removal.
- C. Blasting shall not be allowed.

1.2 UNIT PRICE –PAYMENT

- A. Excavation for this project is unclassified except for Unsuitable Soil, Mass and Trench Rock. Rock encountered shall be removed per these specifications in accordance with the unit price identified on the Bid Form.

1.3 DEFINITIONS

- A. Rock (Mass or Trench): Solid mineral material with a volume in excess of 1/3 cu yd (0.25 cu m) and that cannot be removed with a ¾ cu yd (0.57 cu m) capacity power shovel without drill or blasting.

1.4 SCHEDULING

- A. Schedule Work to avoid disruption to work in occupied buildings nearby.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 01.
- B. Verify site conditions and note subsurface irregularities affecting work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Deliver materials to job-site in their original, unopened containers, with all labels intact and legible at the time of use and bearing the manufacturer's warnings to be observed in the handling and use of chemicals.

- C. Provide adequate protection of all materials and equipment before, during and after execution of the Work.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for foundations.
- E. In utility trenches, excavate to 6 inches (150 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 23 - Backfilling.

3.4 FIELD QUALITY CONTROL

- A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock

END OF SECTION

SECTION 312323
BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building perimeter and site structure backfilling to subgrade elevations.
- B. Site backfilling.
- C. Fill under slabs-on-grade.
- D. Fill in landscaped beds/areas.
- E. Fill for over-excavation.
- F. Consolidation and compaction as scheduled.

1.2 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 SUBMITTALS FOR REVIEW

- A. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of subsoil fill from each source to be used.
- B. Samples: Submit to testing laboratory, in air-tight containers, 10 lb (4.5 kg) sample of each type of aggregate fill from each source to be used.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Fill Type S1: As specified in Section 31 05 13.

- B. Structural Fill Type A3: As specified in Section 31 05 16.
- C. Topsoil Fill Type T1 or T2: As specified in Section 31 05 13.
- D. Concrete: Lean concrete conforming to Section 03 30 00 with a compressive strength of 1,000 psi (7 MPa).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify sub-drainage, damp proofing, or waterproofing installation has been inspected.
- B. Verify structural ability of unsupported walls to support loads imposed by the fill. Allow necessary time for curing and provide adequate bracing prior to backfilling.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Type A4 fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify and proof roll subgrade surface to a depth of 1 inch (13 mm) to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric where required over Type A2 fill prior to placing next lift of fill.
- D. Soil Fill Type S1: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- E. Employ a placement method that does not disturb or damage other work.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundation walls and retaining walls. Do not backfill against unsupported walls.

- H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- I. Maintain minimum grade away from building per Section 31 22 13 – Rough Grading.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Stockpile in sufficient quantities to meet Project schedule and requirements where specified in Section 31 22 13 – Rough Grading. Remove excess material and material unsuitable for reuse as fill from site.

3.4 TOLERANCES

- A. Top Surface of Backfill (Subgrade): Plus or minus 0.1 foot (30 mm) within 100 feet of buildings, under all pavement and site improvements (such as athletic/play fields); and 0.25 foot (75 mm) on surrounding fields and slopes.

3.5 FIELD QUALITY CONTROL

- A. Section 31 09 00 - Geotechnical Engineering, Inspection, and Testing.
- B. Compaction testing will be performed in accordance with ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: Meeting requirements listed in Section 31 22 13 – Rough Grading

	<u>Max. Lift Thickness</u>	<u>Tests (per Lift)</u>
Backfills (Exterior)	8"	1 per 2,500 s.f.
Under Paving, Curbs, Walks, Footings, and Slabs on Grade	8"	1 per 1,000 s.f.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

- A. Interior Crawl Spaces:
 - 1. Fill Type S1, sufficient to equalize load on wall exterior, compacted to 90 percent.
- B. Interior Slab-On-Grade:
 - 1. Fill Type S1, per section on Drawings, compacted to 95 percent,
 - 2. Cover with Fill Type A3, per section on Drawings, compacted to 95 percent.

- C. Exterior Side of Foundation Walls, Retaining Walls and Over (geotextile protected) Granular Filter Material and Foundation Perimeter Drainage Stone:
 - 1. Fill Type S1, per structural details to subgrade elevation, each lift, compacted to 90 percent.
- D. Fill Under Grass Areas:
 - 1. Fill Type S1, to rough grade, compacted to 90 percent.
- E. Fill Under Landscaped Areas:
 - 1. Fill Type S1, to rough grade, compacted to 90 percent.
- F. Fill For Berming:
 - 1. Fill Type S1, to rough grade, compacted to 95 percent.
- G. Fill Under Asphalt or Concrete Paving:
 - 1. Compact subsoil to 100 percent of its maximum dry density.
 - 2. Fill Type A4, to depth of pavement below finish paving elevation per pavements sections, compacted to 100 percent.
- H. Fill to Correct Over-excavation:
 - 1. Lean concrete to minimum compressive strength of 1000 psi (7 MPa), OR
 - 2. Fill Type A4, flush to required elevation, compacted to 100 percent.

END OF SECTION

SECTION 312513
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 WORK INCLUDED (But is not limited to)

- A. Furnish all labor, equipment and materials to complete and maintain Erosion and Sediment Control (ESC) measures necessary to prepare for and control proposed land disturbance per local and state regulations.
- B. Responsible Land Disturber defined.
- C. Install ESC Structures and Measures.
- D. Maintain Effectiveness of Structures and Measures.
- E. Control Water Run-off.
- F. Control Dust Accumulation.
- G. Control Amount of Disturbed/Unstabilized Area.
- H. Temporary and Permanent Stabilization of Disturbed Areas.

1.2 REFERENCES

- A. Virginia Stormwater Management (VSM) Handbook: Temporary seeding, construction entrances and other measures or practices which may apply.
- B. Virginia Department of Transportation (VDOT) "Road & Bridge Standards & Specifications": Outlet Protection, Channel Sections, Materials, Installation of Measures, etc. (but excluding references to measurement and payment).

1.3 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, plan approving authority, municipal department or other entity which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the Work.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all requirements of the Virginia Erosion & Sediment Control Law pertaining to this project as presented in the VSM Handbook.
- B. Erosion & Sediment Control (ESC):
 - 1. The Contractor shall employ a Responsible Land Disturber who is certified by the Department of Conservation and Recreation. The name of this person is to be designated in writing by the Contractor to the State ESC plan approving authority (LGA) and the Owner along with copies of their certification prior to any land disturbance. The Responsible Land Disturber

for this project shall be in charge of and is responsible for carrying out the land-disturbing activities on this project. The certified Responsible Land Disturber may change at any time during the life of this project, as long as the State ESC plan approving authority is notified in advance and in writing.

2. Obtain and pay for such land disturbing permits as required by the plan approving authorities, including fees and bonds, per Division 0 & 1.
3. The Contractor shall not begin land disturbance until all required permits have been obtained and, if required, posted at the site. Permits may include, but are not limited to, the following:
 - a) Local (or State) Land Disturbance Permit.
 - b) Virginia Stormwater Management Program (VSMP) Permit.
4. The plans have been drawn according to specifications of the VSM Handbook (Latest Edition) and pertinent state regulations. The ESC Narrative shall be considered part of these Contract Documents as required by the State ESC plan approving authority (LGA).

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All Erosion and Sediment Control materials shall conform to the standards set forth in the VSM Handbook unless indicated as VDOT Std. in which case they shall conform to the "Road & Bridge Stds. & Specs."
- B. Construction Entrance Stone: Provide in accordance with the VSM Handbook ~~Std. & Spec. 3-02~~ C-SCM-03.
- C. Construction Road Stabilization Stone: Provide in accordance with VSM Handbook Spec. C-SCM-02. Within areas to be paved and once rough grade has been obtained, the Contractor may use pavement base material as specified and/or indicated in the pavement section on Drawings.
- D. Outlet Protection or Storm Water Conveyance Channel Stone: Provide in accordance with VDOT Std. EC-1 Erosion Control Stone and Spec. 414.03(e) Erosion Control Stone. Stone shall be sound, durable, non-erodible shot rock or rock excavation free from seams, cracks, and other structural defects. Also see sized indicated on the Drawings.
- E. Outlet Protection Stone Geotextile Fabric for bedding shall conform to VDOT Std. &

Spec. Section 245, which includes but is not limited to meeting the following requirements: apparent size opening equal to or greater than No. 50 sieve as tested per ASTM D4751, tensile strength @ 20% maximum elongation of 30 lbs/linear inch minimum as tested per VTM-52, puncture strength of 80 lbs minimum as tested per ASTM D4833, and have seams equal in strength to the basic material. Submit written documentation of test results from an independent commercial lab verifying that material meets specified requirements.

- F. Silt Fence: Woven fabric for use as silt fence around inlets or to protect slopes.
 - 1. Manufacturer - Product:
 - a) Amoco - Propex Silt Stop
 - b) Mirafi, Inc. - Mirafi 100X, Envirofence
 - c) Exxon - GTF 101-S
 - 2. Posts for staking silt fence shall be 1" x 2" wood with a minimum length of 48".
- G. Filter Fabric: Non-woven fabric for use in foundation drain systems, dry wells, lining beneath EC Stone, etc..
 - 1. Manufacturer - Product:
 - a) TC Mirafi – Mirafi 180N
 - b) Amoco Fabrics and Fibers Co. – ProPex 4547
 - c) Reemay, Inc. – Typar 3401
- H. Temporary & Permanent Seeding and Related Items: Provide in accordance with Section 32 92 19 – Seeding.
- I. Water: Water shall be potable and provided in accordance with Section 01 51 00 – Temporary Utilities: Temporary Water.

PART 3 EXECUTION

3.1 GENERAL

- A. Accept premises as found. Owner assumes no responsibility for conditions of the site or continuation of conditions existing at the time of advertisement.
- B. Temporary erosion and sediment control measures are required during construction and shall be installed prior to any clearing, grading or other construction, and to the minimum standards and specifications of the ~~ESC~~ VSM Handbook. Comply with all minimum standards of the Virginia Erosion and Stormwater Management Regulations, 9VAC25-875 of the Code of Virginia.
- C. Permanent storm water management measures are required for the project and shall be installed to the minimum standards and specifications of the VSM Handbook. Comply with all minimum standards of the Virginia Erosion and Stormwater Management Regulations, 9VAC25-875 et seq.
- D. The erosion control and storm water management plans as approved by the LGA shall be made part of these Contract Documents. This includes the ESC Narrative.
- E. Prior to initial disturbance of earth, comply with all applicable standards and

ordinances to prevent soil erosion and siltation. Install, construct and maintain such measures as shown on Drawings and all others as required by the inspecting authorities having jurisdiction.

- F. Be responsible for satisfying any and all erosion control and storm water management requirements for any land disturbing activities, including but not limited to on-site or off-site borrow, on-site or off-site stockpiling or disposal of waste materials. Before undertaking any land disturbing activity for which the Contract Documents do not specifically address erosion control and storm water management (such as off-site borrow and waste areas), contact the Regional Office of the Division of Soil and Water Conservation (SWC) or other LGA to determine what Erosion Control and storm water management measures are necessary. Completely satisfy all requirements of the LGA, including payment of design, review, and permit expenses, before continuing with the concerned activity.
- G. Dust Control: Any material which will result in dust shall be wet down during the work.
- H. Use whatever means necessary to prevent mud and dirt from being carried onto public streets.
- I. Should mud and dirt accumulate on streets execute immediate cleaning methods to remove accumulation.

3.2 PREPARATION

- A. Assure that all pertinent required permits have been obtained.
- B. Notify LGA of intent to begin work.
- C. Verify that existing trees/plant life designated to remain, are conspicuously marked as such.

3.3 PROTECTION

- A. Protection of adjacent properties and waterways: Prior to any land disturbance activity install Erosion and Sediment Control measures. See Site Drawings for specific practices required to prevent soil from washing from areas disturbed during clearing operations. Maintain all ESC measures required.
- B. Protection of Existing Trees and Vegetation:
 - 1. Provide protection for existing trees, plant growth, and features designated to remain against compacting the root zone, unnecessary cutting, breaking, skinning of roots, or bruising of bark. Conform to details and specifications of the VSM Handbook for methods of protection.
 - 2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the Architect.

3.4 EROSION & SEDIMENT CONTROL MEASURES

A. General:

1. The LGA reserves the right to require more ESC measures if field observation of in place measures shows they are inadequate for the task.
2. Maintain erosion control during construction until permanent pavement, plantings and restoration of natural areas is effective in controlling erosion.
3. Plan and execute construction by methods to control surface drainage from cut, fill, borrow and grading areas.
4. Minimize amount of bare soil exposed at one time.
5. Schedule operations so ground surface will be disturbed for shortest possible time before permanent construction is installed.
6. Maintain large areas as flat as practicable to minimize soil transfer through surface flow.
7. Storm Drainage System: Install as much of permanent system as soon as practicable and divert surface water into system, with remainder of system installed as soon as conditions allow. Coordinate with Section 33 41 00 - Site Storm Drainage System.
8. Repair washed and eroded areas. Re-establish required grades, densities, elevations, profiles and contours. Re-seed as required.

B. Temporary Construction Entrance:

1. A construction entrance is required at all locations where construction vehicles enter a public right-of-way. During wet weather conditions, clean the wheels of construction vehicles prior to their accessing public streets.
2. Install and maintain in accordance with VSM Handbook Spec. C-SCM-03, to the extent shown on Drawings.
3. No point of vehicular access onto the disturbed earthen portion of the site shall be utilized other than the Construction Entrance (CE) shown on Drawings. Access is allowed from pavement directly onto Construction Road Stabilization (CRS) but not from CRS onto disturbed earth.
4. Place stone to the dimensions shown on Drawings (default: 12' width x 70' length, minimum) and at a depth of 6 inches minimum. A wash rack and temporary water service may be required by the LGA at their discretion.
5. In addition to periodically adding clean stone to the construction entrance and maintaining the edges, the Contractor is required to clean all mud, soil and debris from public roadways which originates from the project site on a daily basis.

C. Construction Road Stabilization:

1. Install and maintain in accordance with VSM Handbook Spec. C-CSM-02, as required for the job trailer, construction parking, building access, and storage.
2. Additionally 6-inch depth of roadway base stone shall be placed immediately after final subgrade elevations are established in the portions of the site indicated on Drawings. Should additional portions of the site require stabilizing, such as parking areas, the Contractor shall utilize the same stone size and depth as required herein for roads. See pavement sections on Drawings.

D. Silt Fence:

1. Install and maintain in accordance with VSM Handbook Spec. C-PCM-04 to the extent shown on Drawings.
 2. Drive posts a minimum of 12 inches into the ground at a maximum spacing of 10 feet. Maximum height above grade shall be 36 inches.
 3. At the base of the posts on the up hill side, excavate a continuous shallow trench.
 4. Staple, wire or attach filter fabric to the post according to the manufacturer's instructions, leaving 8 inches of fabric along the bottom.
 5. Extend bottom surplus of fabric into the trench. Backfill and compact the soil over the trench providing a secure anchor.
- E. Storm Drain Inlet Protection for Drop Inlets:
1. Install and maintain in accordance with VSM Handbook Spec. C-SCM-04, using filter fabric as herein specified.
 2. Space posts around the perimeter of the inlet at 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 15 and 18 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
- F. Storm Drain Inlet Protection for Curb Drop Inlets:
1. Install and maintain in accordance with VSM Handbook Spec. C-SCM-04, using filter fabric as herein specified.
 2. Place fabric over throat of inlet such that at least 12 inches extends across the top surface of the structure and 12 inches extends across the flow line or gutter line.
 3. Place VDOT #1 stone along the top and gutter line edges of the fabric to anchor the edges, then place stone along throat area of inlet.
- G. Storm Drain Inlet Protection for Culverts:
1. Install and maintain in accordance with VSM Handbook Spec. C-SCM-05, using material as herein specified.
 2. Space posts around the perimeter of the culvert inlet placed approximately 6 feet up stream from the culvert at a maximum of 3 feet on center and drive 12 inches into the ground. The height above-grade of the posts shall be between 16 and 36 inches.
 3. Excavate a shallow trench around the perimeter of the posts.
 4. Staple, wire or attach fabric to the posts according to the manufacturer's recommendations, leaving 8 inches of surplus fabric along the bottom.
 5. Extend bottom of fabric into the trench, backfill and compact over the trench.
 6. If the above proves insufficient to provide protection from silt entering the culvert, replace with the Optional Stone Combination as detailed in VSM Handbook Figure C-SCM-05-1.
- H. Outlet Protection or Storm Water Conveyance Channel:
1. After surrounding area has been brought to subgrade, excavate to subgrade elevations for OP or SCC as indicated from finish grade on plans less EC Stone depth in detail.
 2. Compact subgrade to requirements for surrounding subgrade under

- applicable earthwork section.
3. Install bedding geotextile fabric in accordance with detail, overlapping joints 6 inches minimum and stapling per manufacturer's recommendations and entrenching entire perimeter of fabric 9 inches. Compact fabric entrenchment to requirements of surrounding subgrade.
 4. Place, do not dump, Erosion Control Stone to the dimensions and configuration indicated on the applicable detail.
- I. Erosion Control/Re-vegetation Mat:
1. Install Erosion Control Mat in accordance with VDOT Std. EC-2 or EC-3 in the locations shown on Drawings or as otherwise indicated.
 2. Install Re-vegetation Mat in the locations shown on Drawings or otherwise indicated. Mat shall conform to Part 2 of Section 32 92 19 - Seeding.
 3. Shape and grade the channel or slope; remove all rock and debris.
 4. Place and compact topsoil to the depth previously specified.
 5. Apply fertilizer, lime and seed at the rates specified for seeded lawn areas in Section 32 92 19 – Seeding.
 6. Place and secure the mat as described in Part 3 of Section 32 92 19 – Seeding.
- J. Sediment Basin (temporary) / Detention Basin (permanent):
1. Install sediment basin in accordance with and at the location shown on the Drawings. This shall be part of the first work accomplished since it is the primary measure to control sediment from leaving the site from further land disturbance. Refer to ESC Sequence on the Drawings.
 2. Basin shall double as the permanent detention basin and as such shall be carefully constructed to assure the long-term water restraining integrity of the earthen berm. Berm construction shall be performed in accordance with Virginia Stormwater Management Handbook (Latest Edition), Section ~~3-04~~ P-SUP-01, Earthen Embankments and details on the Drawings.
 3. Extreme care shall be taken when closing the berm across the existing drainage channel since it drains a large, developed area.
 4. As a sediment basin, the primary outlets shall be modified as detailed on the plans to act as dewatering devices.
 5. Upon stabilization of the site, the sediment basin shall be converted to the detention basin by cleaning out any sediment, dressing to rough grade, topsoiling to finished grade, seeding, and landscaping. The dewatering device shall be removed and all orifices cleanly trimmed (square, sharp, without burrs, and removing any bends, tees or caps used for the dewatering device installation both inside and outside the outlet structure. Any concrete channel lining or pads proposed within the basin shall also be placed at this time.
- K. Temporary Seeding:
1. Temporary seeding shall be applied to denuded areas within seven (7) days after final grade has been established and to portions of the site which may not be at final grade but which will remain inactive for more than 14 days and less than one year. Lawn areas and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified in Section 32 92 19 – Seeding. Permanent Seeding is required for areas which will remain

dormant for more than one year.

2. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
3. Apply lime at a rate of 50 pounds per 1000 sq. ft. and 10-20-10 fertilizer at 14 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
4. Seed shall be evenly applied at a rate of 1-2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
5. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
6. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
7. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting according to Section 32 92 19 – Seeding.
8. Areas which fail to establish initial vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized. Matting and blankets shall be installed on areas which fail to establish subsequent vegetative efforts.

L. Topsoil/Soil Materials Stockpile: Do not stockpile in drainage ways or within the drip line of trees. Stockpile to a depth not exceeding 8 feet (2.5 m) and with side slopes not exceeding 2H:1V. Protect from wind and water erosion and from admixture of debris.

M. Concrete Washout Pit: See detail on Drawings.

3.5 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROLS

- A. Remove temporary erosion and sediment control measures within 30 days after permanent lawn areas have become substantially established as defined in Section 32 92 19 - Seeding or after the temporary measures are no longer required as determined and authorized by the local program administrator. Permanently stabilize disturbed soil areas resulting from the disposition of temporary measures to prevent further erosion.

END OF SECTION

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- C. Warranties: Sample of special warranties.

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.

- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single manufacturer.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
 - d. Syngenta; Demon TC, Prelude, Probuild TC.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified

concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 321216
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Asphaltic Concrete Paving; surface/wearing course and base/binder course.
- B. Surface sealer, primer/tack coat.
- C. Aggregate Base Course; depth and compaction.

1.2 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department or other entity which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the work.

1.3 REFERENCE STANDARDS

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Asphalt Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.5 SUBMITTALS FOR REVIEW

- A. Submit certification from Asphalt batch plant for proposed mix design of each class of mix for information prior to beginning of work.
- B. All products identified in PART 2 of this specification.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not produce or place asphalt when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- B. Other materials shall be placed or installed per manufacturer's recommendations.

1.7 BARRICADES AND SIGNALS

- A. Within public right-of-way, provide and maintain temporary signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices in accordance with DOT D-6.1 to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the VDOT Inspector, LGA, or Architect/Engineer, as applicable.
- B. On-site, provide and maintain temporary signs, signals, lighting devices, markings, and barricades to protect personnel and new construction from damage by equipment and vehicles until the surface is approved by the Architect/Engineer.

1.8 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base under Asphalt Pavement: Coarse Aggregate Type A4 in accordance with Section 31 05 16 - Aggregate Materials (see Pavement Sections on Drawings).

2.2 ASPHALTIC CONCRETE PAVING

- A. Primer, Tack & Seal Coats: In accordance with VDOT Section 210, Asphalt Materials.
- B. Asphalt Base Course: In accordance with VDOT Section 212.20, Type BM-25.0 bituminous concrete.
- C. Asphalt Surface Course: In accordance with VDOT Section 212.17, Type SM-9.5D bituminous concrete.

2.3 ACCESS ROADWAY ALIGNMENT MARKERS

- A. Refer to Landscape Drawings for a landscape response to denoting the roadway alignment.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Section 31 09 00 – Geotechnical Engineering, Inspection, and Testing: Aggregate and asphalt testing. Compaction testing. Geotechnical Engineer.
- B. Have required tests made by Geotechnical Engineer (in lieu of VDOT) per Reference Standard. Submit all VDOT required information to VDOT as applicable. Test asphalt samples for depth and density.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.
- B. Ensure that all existing utility structures, new or existing, have been adjusted to meet proposed finished grades prior to paving.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Asphalt Pavement: Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth and true to grade and cross section until asphaltic concrete placement.

3.3 PREPARATION

- A. Protect finished surfaces adjacent to asphalt work from overspray, damage by equipment, etc.
- B. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- C. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- D. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact

and inspect the adjusted section after correcting.

E. Asphalt Pavement - Primer:

1. Apply a prime coat on the finished stone base course at a rate of 0.25 gallon residual asphalt per square yard. Allow prime coat to cure for a minimum of 48 hours prior to placing asphaltic concrete. Apply cutback asphalts when the stone base course is dry. Lightly spray stone base with water immediately prior to application of emulsified asphalts. During prime coat placement, minimum ambient temperature shall be 50 degrees F and rising. Maintain and protect primed surfaces from damage until asphaltic concrete placement.
2. Apply primer in accordance with VDOT Section 311 - Prime Coat.
3. Apply primer to contact surfaces of curbs and gutters.
4. Use clean sand to blot excess primer.

F. Asphalt Pavement - Tack Coat:

1. Apply tack coat on existing pavement to be overlaid at a rate of 0.10 gallon residual asphalt per square yard. Thoroughly clean surfaces to receive the tack coat immediately prior to application of tack coat. Tack coat shall be tacky at the time of asphaltic concrete placement.
2. Apply tack coat in accordance with VDOT Standards.
3. Apply tack coat to contact surfaces of curbs and gutters.
4. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

G. Asphalt Pavement - Seal Coats:

1. Apply asphalt and cover material in accordance with VDOT Section 312 - Seal Coat.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with VDOT standards.
- B. Place to compacted thickness identified in details on Drawings.
- C. Install drainage tops/frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place base/binder course to compacted thickness identified in details on Drawings.
- B. Place surface/wearing course within two (2) hours of placing and compacting binder course.
- C. Place surface/wearing course to compacted thickness identified in details on

Drawings.

- D. Install drainage tops/frames in correct position and elevation.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.6 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch (6 mm).
- C. Variation from True Elevation: Within 1/2 inch (12 mm).
- D. Assure that drainage swales over pavement function as designed.

3.7 FIELD QUALITY CONTROL

- A. Field testing methods shall be as determined by the Geotechnical Engineer.

3.8 PROTECTION OF ASPHALT

- A. Immediately after placement, protect pavement from premature drying and excessive hot or cold temperatures. Also, protect pavement from mechanical injury for one (1) day or until surface temperature is less than 140 degrees F (60 degrees C).
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

3.9 SCHEDULES

- A. Refer to details on the Drawings.

END OF SECTION

SECTION 321313
PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete sidewalks, stairs, integral curbs, curb &/or gutters.
- B. Aggregate base course.
- C. Exterior concrete flatwork joint sealant.

1.2 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM C698 - Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- G. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.

1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compounds and ADA tactile warning mats.
- C. All products identified in PART 2 of this specification.
- D. Submit certification from Concrete batch plant for proposed mix design of each class of mix for information prior to beginning of work.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Concrete Mixing Plant: VDOT Certified.
- D. Obtain materials from same source throughout.

1.5 REGULATORY REQUIREMENTS

- A. Conform to VDOT review, approval and inspections per VDOT Stds.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Materials, other than concrete, shall be placed or installed per manufacturer's recommendations.

PART 2 PRODUCTS

2.1 AGGREGATE BASE (unless detailed otherwise)

- A. Sidewalks and Flatwork: Aggregate for Base Course: Type A3 per Section 31 05 16 - Aggregate Materials.
- B. Concrete Pavement and Curbing: Aggregate for Base Course: Type A4 per Section 31 05 16 – Aggregate Materials.

2.2 FORM MATERIALS

- A. Steel form material, profiled to suit conditions.
- B. Joint Filler: Asphalt impregnated fiberboard, 1/2 inch thick by full depth of concrete pavement less 1/2 inch allowance for joint sealant.
- C. Curbing Joint Filler: Asphalt impregnated fiberboard, 1/2 inch thick by full depth of VDOT Std. CG-2 (curb only) or CG-6 (curb & gutter) as indicated less 1/2 inch allowance for joint sealant. See Drawings for delineation.

2.3 REINFORCEMENT

- A. Reinforcing Steel and Welded Steel Wire Fabric: Type specified in Section 03 30 00 - Cast-in-Place Concrete.

- B. Dowels: ASTM A615; 40 ksi (276 MPa) yield grade, plain steel, galvanized finish.

2.4 CONCRETE MATERIALS

- A. Concrete shall be VDOT Std. Class A4 for walks and stairs and Class A4 within traffic bearing areas. Concrete for storm pipe cradle shall be VDOT Std. Class A3 or greater.
- B. VDOT Specification Modifications:
 - 1. Slump: Admixtures shall be added to adjust slump to 5.5 inches. Further adjustments shall be made to address workability during hot or cold weather conditions. Adhere to VDOT Specifications for slump when slip forms are used.
 - 2. Curing compounds shall dry clear (no pigment).
- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Water: Potable, not detrimental to concrete.

2.5 ACCESSORIES

- A. Method of Curing: Membrane Curing Compound meeting requirements of Section 03 30 00 - Cast In Place Concrete.
- B. Joint Sealant: Provide manufacturer's full color range within submittal for Owner and A/E review and approval.
 - 1. Materials: Two-part, Urethane: Multi-components, non-sag, plus 50% and minus 50% movement capability, traffic and nontraffic use; ASTM C920, Type M, Grade NS, Class 50, Use T and NT
 - 2. Backing: Use pre-molded plastic zip out products of the specified width and depth. Backing shall closely match the color of the concrete placed. Leave no ends or jagged edges of zipped out backing visible or within the sealant bead.

2.6 FINISH

- A. Finish for exterior flatwork shall be per schedule at the end of this Section.
- B. Edges of exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.
- C. Crack control joints for exterior flatwork shall be quarter round tooled after broom finish and left with steel troweled appearance and slightest depression below the interior surface.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 40 00 - Quality Requirements: Quality assurance testing.

- B. Section 31 09 00 - Geotechnical Engineering, Inspections, and Testing.
- C. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- D. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- E. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify base conditions under provisions of Div. 1. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that compacted subgrade is dry and ready to support paving/surfacing and imposed loads. Verify that gradients and elevations of base are correct.

3.2 PLACING AGGREGATE BASE COURSE

- A. For Concrete Pavement: Place base material of sufficient width to support formed work and extend beneath curbing where adjacent. Compact to 100 percent ASTM D-698 maximum dry density. Maintain the base smooth, compacted, well bonded, and true to the designed cross section until concrete placement.

3.3 PREPARATION

- A. For repair work, cut existing surface back to undisturbed material to provide uniform division lines between existing and new work.
- B. Butt new work to existing surfaces to result in smooth transitions and uniform sections.
- C. Before placing surface, inspect the subgrade and base for conformity with the specified section. If necessary, remove or add material to bring all portions of the subgrade and base to proper section and correct elevation. Thoroughly compact and inspect the adjusted section after correcting.
- D. Moisten base to minimize absorption of water from fresh concrete.
- E. Coat surfaces of manhole and drainage structure frames with oil to prevent bond with concrete pavement.
- F. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Steel forms are preferred. Wood forms with appropriate bracing may be allowed with prior approval of form installations by the Architect. Slip forms shall be used for all curb and gutter applications (with noted adjustment for slump).
- B. Place and secure forms to correct location, dimension, profile, and gradient.
- C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

- A. Place reinforcement as indicated in details on Drawings.
- B. Interrupt reinforcement at expansion joints. Where new concrete is continuous, install dowels through the fiber board with one end greased or capped sleeve.
- C. Place dowels to achieve pavement and curb alignment as necessary to prevent differential settlement of adjacent work. One end of dowel shall be set in capped sleeve to allow longitudinal movement (typical of all installations).
- D. Provide dowels at expansion joints. Place dowels at 4 feet OC maximum with two (2) per connection min.
- E. Where slabs exceed 500 SF and are not otherwise segmented by expansion joints provide keyed and doweled, longitudinal construction joints at maximum of 12 feet (3.66 m) OC.

3.6 PLACING CONCRETE

- A. Measure, mix, transport, and place concrete in accordance with ACI 304 unless superceded by VDOT Section 217.10. Curing (clear, no pigment) shall adhere to product manufacturer's recommended instructions. Use of admixtures shall be approved in advance by the Architect.
- B. Do not produce or place concrete when the weather is rainy or foggy, when the subgrade is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.
- C. Place concrete for curbs and gutters using the slip form technique. Ensure base stone for curbing has been compacted and is undisturbed.
- D. Ensure reinforcement, inserts, embedded parts, formed joints, etc. are not disturbed during concrete placement.

- E. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Place concrete to pattern indicated. Default to VDOT Spec. if none indicated.

3.7 JOINTS

- A. Place joint filler in pavement pattern placement sequence as indicated on the Drawings. Place joint filler between paving components and building or other appurtenances. Place joint filler where new concrete work meets existing concrete.
- B. For linear work place expansion joints at 30 foot (9 m) intervals unless otherwise indicated. Align curb, gutter, and sidewalk joints where adjacent.
- C. Set top to required elevations. Secure to resist movement by wet concrete.
- D. Recess top of filler ½ inch (13 mm) for joint sealant placement.
- E. Use joint sealant for caulking all joints in concrete pavements, curbs, and walks.
- F. Provide tooled control joints per VDOT specs to pattern indicated (with 6' OC as default value). Verify pattern with Architect prior to concrete placement.
- G. Provide keyed joints as indicated.

3.8 FINISHING & CURING

- A. Finish per schedule at the end of this section. Avoid over-finishing!
- B. Direction of Texturing: Transverse to pavement direction, unless otherwise indicated in schedule.
- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with Manufacturer's instructions.

3.9 JOINT SEALING

- A. Separate pavement from vertical surfaces with ½ inch (13 mm) thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- C. Extend joint filler from bottom of pavement to within ½ inch (13 mm) of finished surface.

3.10 CURBS

- A. Install VDOT Std. CG-2 (curb only) and/or VDOT Std. CG-6 (curb & gutter) as delineated on the Drawings. Provide a minimum of 6" VDOT Std. 21-A

compacted stone base under all curbs and curbs & gutter. Typically upslope curbing may be curb only. Provide also for dry-pan or reverse gutters at locations required to prevent ponded water. This shall be verified and coordinated in advance with the Architect. Apply joint sealant at expansion joints (omit backing – filler only).

- B. Wiped down or submerged curbs (see details) shall have machined finish matching typical CG-2 finish.

3.11 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Quality Assurance. Tolerances.
- B. Maximum Variation of Surface Flatness: ¼ inch (6 mm) in 10 ft. (3 m).
- C. Maximum Variation From True Position: ¼ inch (6 mm).

3.12 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspection and testing.
- B. Section 31 09 00 – Geotechnical Engineering, Inspections, and Testing.
- C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- D. Three concrete test cylinders will be taken for every 75 or less cu. yds. (57 or less cu m) of each class of concrete placed each day.
- E. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- F. One slump test will be taken for each set of test cylinders taken.
- G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.13 PROTECTION

- A. Section 01 70 00 – Execution Requirements: Protection of Completed Work.
- B. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.14 SCHEDULE

- A. Area Paving: As detailed on Drawings with Light broom finish as default. Verify with Architect prior to placement of concrete.

- B. Sidewalk Paving: Light broom, radius to ¼ inch (6 mm) radius, and trowel joint edges.
- C. Curbs and Gutters: Light broom.

END OF SECTION

SECTION 321723
PAVEMENT MARKING AND SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pavement Marking & Related Signage.
- B. Relocation of existing signage.

1.2 DEFINITIONS

- A. Local Governing Authority (LGA) - The state agency, municipal department, or other entity, which legally has jurisdiction over the referenced work or activity. This usually means the field official who makes or controls onsite inspections of the work.

1.3 REFERENCE STANDARD

- A. Virginia Department of Transportation "Road & Bridge Standards & Specifications", latest edition. VDOT section numbers referenced herein refer to sections in these Road & Bridge Specifications. The provisions therein for method of measurement and payment do not apply.
- B. Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement), latest edition.
- C. Americans With Disabilities Act (ADA): 28 CFR Part 36, Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; Final Rule dated July 26, 1991.
- D. Local Governing Authority Regulations pertaining to work of this section (i.e. handicapped parking marking and signage requirements, fire lane marking and signage requirements, etc.).

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Reference Standards above. Refer to ACI 304 for any concrete related item not covered in Reference Standard. Maintain one copy of the reference utilized onsite with Contract Documents.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with industry standards, the specified requirements and the methods for proper performance of the work of this section.
- C. Obtain materials from same source throughout.

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures.

- B. Product Data: Provide data on paint materials.
- C. Submit certification from sign supplier for all signage provided that they meet applicable standards above.
- D. All products identified in PART 2 of this specification.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 60 00 – Product Requirements: Product delivery and Product storage and handling.
- B. Deliver products to site in Manufacturer's sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Paint Materials: Store all paint materials in a single location at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by Manufacturer's instructions. Protect from danger of combustion.

1.7 REGULATORY REQUIREMENTS

- A. VDOT review, approval and inspections per VDOT Stds.

1.8 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1.10 WARRANTY

- A. Section 01 70 00 - Execution Requirements: Requirements for warranties.
- B. Furnish one-year manufacturer's warranty for traffic paints and products.

PART 2 PRODUCTS

2.1 EXISTING SIGNAGE

- A. Existing traffic signage may be reused if not damaged and meeting current specifications.

2.2 PAVEMENT MARKING AND SIGNAGE

- A. Provide all identification, fire lane, traffic control and ADA signage indicated on Drawings and per schedule this section. Signs shall meet minimum standards of local fire department/marshal, ADA and Manual of Uniform Traffic Control Devices (MUTCD, including Virginia supplement) for all components. Sign posts shall meet VDOT Stds. & Specs.
- B. Plans have been reviewed and approved by the VDOT and the local governing authority (LGA). If, upon construction compliance inspection by VDOT and LGA building inspector, any signage is lacking per requirements of VDOT, ADA or local code, the Contractor shall provide and place such signs as necessary for compliance at no additional cost to the Owner.
- C. Provide pavement markings in accordance with VDOT Standards. Parking lot striping shall be thermoplastic, Type B, Class I road markings and striping. Use white for pavement markings, and direction arrows on asphalt (OSHA yellow on concrete) unless otherwise required by reference standards.
- D. Reference ADA requirements and local regulations for handicapped space marking configuration and colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate the Work and verify pavement conditions. Verify that all pre-requisite work (subsurface utilities, etc.) has been completed and is ready to receive the work of this section. Verify that pavement is ready to support paving/surfacing and imposed loads. Verify that finish grade of lawn areas are correct.
- B. Verify that surfaces or substrate conditions, as applicable, are ready to receive Work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Do not apply paint to concrete surfaces until concrete has cured for 28 days
- E. Verify locations, requirements, and extent of work.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask any adjacent or attached items which are not to receive applied material prior to preparing surfaces or finishing.

- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

3.3 APPLICATION

- A. Procedure: Apply products in accordance with manufacturer's instructions.
- B. Dry Receiving Surface: Do not apply finishes to surfaces that are not dry. Allow applied coats to dry thoroughly before next coat is applied.
- C. Acceptance: Owner's representative shall determine quality and consistency of coverage, color and finishes. Remove, refinish or repaint work not complying with requirements.

3.4 PAVEMENT MARKINGS

- A. Place required pavement marking and signage in accordance with ADA or Manual of Uniform Traffic Control Devices (MUTCD including Virginia Supplement), as applicable. See Schedule this section. For parking space designation signs provide 36 inch deep by 12" square or round VDOT Std. Class A3 concrete base for signs. See pavement marking and Exterior Handicap Sign detail on the Drawings.
- B. Traffic islands and no parking areas (as shown on plan) shall consist of a four (4) inch wide white thermoplastic line border, entirely on the asphalt (not spilling over onto concrete gutter, etc.), of the width indicated on the plans, with four (4) inch wide white thermoplastic lines at (12) inches apart and at forty-five (45) degrees to the border throughout the enclosed area. Verify orientation with Architect prior to painting.

3.5 FIELD QUALITY CONTROL

- A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- B. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Coverage, Retention: Prepare defective material by acceptably scraping, grinding or blast cleaning to remove substantial amount of material and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot (300 mm) beyond affected area. Apply new markings on cleaned surface in accordance with this Section.
- C. Replace defective pavement markings as specified throughout warranted period.

- D. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need to be replaced.
- E. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during warranty period:
 - 1. Marking exhibits obvious discoloration or pigment loss.
 - 2. More than 15 percent of area of continuous line within any line segment is missing.

3.6 CLEANING

- A. At the end of each workday, collect empty cans, rags, rubbish, backing paper, and other discarded materials. Place in closed metal containers, and remove daily from the site.
- B. At the completion of construction activities of all other trades, touch up and restore damaged or defaced surfaces.

3.7 SCHEDULES

- A. Pavement Marking: Refer to Drawings.
- B. Signage: Refer to Drawings.

END OF SECTION

SECTION 329000
EXTERIOR PLANTING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The extent of landscaping is shown on the drawings and shall include, but not be limited to:
 - 1. Supplying and installing trees and other plant related material.
 - 3. Finished grading of all planting areas.
 - 4. Staking and guying of plant materials.
 - 5. Fertilizing, spraying, pruning and mulching of all plant material.

1.2 QUALITY ASSURANCE

- A. All plants shall meet or exceed the specifications as to quality and size as set forth by the plans or in the current edition of ANSI/Z60.1, "American Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen, whichever is more stringent. No "park quality" materials will be acceptable. Any change in size shall first be approved by the A/E and Bedford County. Substitutions will not be allowed unless adequate proof can be demonstrated that a specified plant cannot be found.
- B. Maintenance Instruction: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work. Meet with Owner, describe maintenance instruction at site prior to substantial completion.
- C. Chemical Application License: Application of herbicide, insecticides and other chemicals, shall be applied under the direction of a person licensed by the Commonwealth of Virginia to apply such chemicals. The License of the Applicator shall include certification for all plants indicated and be current.

1.3 PRODUCT HANDLING

- A. Deliver all materials to the Site in their original containers with all labels intact and legible at time of installation.
- B. Insofar as is practicable, plant materials shall be planted on the day of delivery. In the event this is not possible, the Contractor shall protect that stock not planted. Protect plants from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well watered and protected. Plants shall not remain unplanted for longer than three days after delivery. ALL plants shall be lifted and handled from the bottom of the ball only. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during plant operations. All foliage-bearing plants stored during summer months or winter months shall be treated with anti-dessiccants.
- C. In the event of damage or rejection, immediately make all replacements necessary to the approval of A/E and at no additional cost to the Owner.

1.5 UTILITIES

- A. The exact location of all existing and proposed underground and overhead utilities shall be verified by the Contractor and he shall conduct his work so as to prevent interruption of service and damage to any system. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him or to make necessary adjustment in their location if required in order to complete the work of this contract.
- B. Should the Contractor damage any utility during his work, he shall replace and/or repair the utility as it existed prior to the damage at his own expense.

1.6 SEQUENCING AND SCHEDULING

- A. Planting time: Proceed with and complete landscape work as rapidly as portions of site become available. Work within seasonal limitations for each kind of landscape work required.
- B. No planting shall be done in frozen ground, when snow covers the ground or when the site is muddy.
- C. If planting is done during the summer months special precautions shall be taken to ensure that the plants do not dry out. If it is deemed necessary to plant during summer months, plants shall be treated with anti-desiccants, and be watered daily or tree bags or diapers provided.

PART 2 PRODUCTS

2.1 FERTILIZER

- A. All Fertilizer shall be a commercial balanced formula with at least 25% organic material, and shall conform to applicable state fertilizer laws. Fertilizer will be "Briquettes" as manufactured by Wood Ace, or approved equal for trees. It shall be a slow release formula, and used as specified by manufacturer. Fertilizer shall be delivered mixed as specified, in standard size, unopened containers, showing weight, analysis, and name of manufacturer. If stored at the site, it shall be kept in a weatherproof place where its effectiveness will be unimpaired.
- B. Fertilizer for plant installations which occur in the Fall shall be a 5-10-10 analysis. Spring installations shall be 10-10-10 analysis.

2.2 TREE STAKING

- A. Tree Stakes: 2" x 2" wood posts, 8'-0" long.
- B. Rubber Hose: Two-ply, fabric-bearing hose having an inside diameter of not less than one-half inch, black in color.
- C. Guy Wire: Galvanized malleable iron wire No. 14 gauge or UV resistant polypropylene tree straps.

2.3 PLANTING SOIL

- A. Soil shall be clean and free of clay lumps, stones, roots, and deleterious substances two inches or more in diameter. It shall be a mixture of the following materials in quantities specified:
 - a. For tree planting pits use a mixture of the following materials in quantities specified: one part topsoil, and one part soil from the hole. Soil pH shall be maintained between 5.5 and 7.0. In holes which were in rock, replace rock with topsoil.

2.4 MULCH

- A. Double shredded hardwood bark mulch used locally within the nursery trade for trees and shrubs or an approved equal. Color shall be Natural.

2.5 PLANT MATERIALS

- A. This shall mean all trees and other plants required to be furnished for the project in accordance with plans and specifications.
- B. Refer to drawings for varieties and spacing of plant materials. Quantities shown on drawings shall take precedence over quantities shown on plant list.
- C. Substitutions will not be permitted unless adequate proof is submitted that the materials are not available. Substitutions must be approved by A/E prior to their installation.

PART 3 EXECUTION

- A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify all such work is complete to the point where this installation may properly commence. If other work is not complete, do not begin work until it has been completed so as to allow for installation.
- B. Verify that planting may be completed in accordance with the original design and the referenced standards.

3.1 SOIL CONDITIONS

- A. Contractor shall inspect soil conditions and take notice of all soil or drainage conditions that may be detrimental to any plant material growth. Notify A/E in writing of all such conditions.

3.2 PREPARATION OF PLANTING SOIL

- A. Before planting, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

- B. Place planting soil as follows:

Area

Volume of Planting Soil Mix

Tree Pits and Shrub Pits

Equal to root ball in depth by 2.5 times ball diameter in width.

3.3 PLANTING AND SURFACE PREPARATION

A. Tree Planting:

1. Stake locations of all trees 5' and over in height and outlines of all tree masses.
2. Rake surface clear of stones, debris, rubbish, and trash before pit excavation. Dispose of such material off site.
3. Excavate pits as indicated on Drawings. Tree pits shall be excavated 3 times wider than the diameter of the root ball and only as deep as the root ball to be placed in the hole. If initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.
4. The pit shall be cone-shaped, barely larger than the ball at the bottom and three times the ball diameter at the top as shown on drawing detail.
5. Plants shall be set at the same relationship to finished grade as they were to the ground from which they were dug. Plants must be set plumb and braced in position until prepared topsoil has been placed around the ball and roots. Plants shall be set so that they will be the same depth one year later.
6. The trunk of the tree is not to be used as a lever in positioning or moving the tree in the planting hole.
7. Because some nurseries practice tilling around trees the root flare may be buried several inches deep. In some cases the top of the root ball may be at ground level but the root flare actually is too deep. Proper planting depth requires the root flare to be at or slightly above the finished grade. It is important to determine how deeply the root flare is buried in the ball before it is placed in the planting hole. Sometimes the top of the ball may need to be removed until the root flare is at the proper planting depth. Remove the excess soil on the top of the root ball.
8. Ropes, strings, and wrapping from the top half of the root ball are to be removed after the plant has been set. All waterproof or water repellant wrappings shall be removed from the ball. Remove at least the top half of the wire basket before backfilling.
9. Mulch trees as shown on drawings. Remove any mulch from 1" of base of tree.

3.4 STAKING AND GUYING

- A. Trees shall be supported immediately after planting as shown on Drawings. The wire shall be encased in hose to prevent direct contact with bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut with turnbuckles.

3.5 PRUNING

- A. Each tree shall be pruned in accordance with standard horticultural practice to preserve natural character of plant. Prune only dead or excess material unless otherwise advised by A/E. Cuts over 3/4" in diameter shall be painted with an approved tree paint. Paint shall cover all exposed cambium as well as other exposed living tissue. Paint shall be waterproof, adhesive and elastic, antiseptic, free from kerosene, coal tar creosote or any other material injurious to the tree and shall be approved before it is used. Use "Woodtar" or an approved equal.
- B. All deciduous plants and trees shall be pruned immediately after planting, to the satisfaction of the A/E. Main leaders of trees shall not be cut back. Thin branches out and do not merely cut back. Long side branches, however, may be shortened.
- C. If the natural form of the plant is destroyed by careless pruning or thinning, the plant will be rejected.

3.6 CLEAN-UP

- A. The Contractor shall, periodically or as directed during the progress of the work, remove and properly dispose of debris, rubbish, trash, clippings, prunings, and defective or unacceptable material. Keep clear of hazardous obstructions. Trash burning on the site will not be permitted.
- B. Except for the designated storage area, paved areas shall be kept clean of soil, fertilizer, mulch, trash and debris, and shall be maintained in a broom clean condition at all times.

3.7 PLANT GUARANTEE AND MAINTENANCE PERIOD

- A. Contractor's Maintenance:
 - 1. Contractor's responsibility to plant maintenance under this section shall commence when work begins and continue until Substantial Completion Acceptance of the construction project. Maintenance shall include all necessary watering, cultivating, fertilizing, weeding, pruning, wound dressing, disease and insect control, protective spraying, replacement of unacceptable material, straightening plants which lean or sag, adjustment of any plants which settle or are planted too low, and other procedures consistent with good horticultural practices which are necessary to insure normal, vigorous and healthy growth of all work under this contract.
 - 2. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not wholly or partially as a result of an act or omission of the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.
 - 3. Contractor shall supply to Architect a comprehensive maintenance program for all plant materials on the site for the Owner's use. It should indicate such areas as, fertilizing, pruning, wound dressing, insect control,

watering and general care necessary to ensure survival of the material and good healthy plants.

3.8 CONTRACTOR'S GUARANTEE PERIOD

- A. Planting work shall be guaranteed for one (1) year from date of Substantial Completion. Replacement plants are guaranteed one year from their planting date.
- B. After Substantial Completion Acceptance of the construction project, if the Contractor is not responsible for maintenance because the Owner has taken-over this task, he is responsible to see that a proper maintenance program is being undertaken. The Contractor should make periodic site visits to insure that the Owner is supplying proper care for plant materials. Notify Architect in writing of observations within seven days of site visit.
- C. Should the Contractor not follow through on his inspection visits, and plant material dies due to lack of maintenance by the Owner, the Contractor could be held responsible and replacements made at his expense. It is his responsibility to advise the Architect of conditions that may affect his plant materials, and the guarantee. This will be in effect for the full one year plant guarantee.

3.9 FINAL INSPECTION

- A. Contractor shall notify the Owner and Architect upon completion of guarantee. Contractor shall request final inspection prior to end of guarantee period.
- B. Should any plant material be dead, or in an unhealthy state of growth as determined by the Architect at the end of the one year period, Contractor shall make all work acceptable and request a reinspection by the Owner and Architect. Any replaced plant material is guaranteed one year from the replacement plants' planting date.

END OF SECTION

SECTION 329119
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Providing, placing on previously prepared subgrade, and grading topsoil to finish grade.

1.2 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures.
- B. Topsoil source.
- C. All products identified in PART 2 of this specification.

PART 2 PRODUCTS

2.1 MATERIAL

- A. Topsoil: Fill Type T1 or T2 as specified in Section 31 05 13 – Soil Materials.
- B. Aggregate: As required in Section 31 05 16 – Aggregate.
- C. Non-woven Geotextile Fabric: As required in Section 31 25 13 – ESC.
- D. Underdrain: As required in Section 33 46 00 – Subdrainage.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building, utility and miscellaneous backfilling have been inspected.
- B. Verify that subgrade has been contoured and compacted and that uneven areas, low spots, and stockpiles have been eliminated.
- C. Do not place topsoil within areas yet to be disturbed by other trades. This may include utility, sidewalk, paving, trellis, sprinkler system or fencing operations.

3.2 SUBGRADE PREPARATION

- A. Establish limits, providing for smooth transition to undisturbed area or other finishes.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove subsoil contaminated with petroleum products, cleaners, paint products, or waste concrete or asphalt.
- C. Scarify subgrade to depth of 3 inches (75 mm) where topsoil is scheduled. Re-scarify in areas where equipment used for hauling and spreading topsoil has

compacted subsoil.

3.3 PLACING TOPSOIL

- A. Use all acceptable, on-site, stockpiled topsoil before importing topsoil. It shall be the Contractor's responsibility to determine the need to import topsoil to complete the project. Latent requests for additional costs due to importing topsoil will not be considered.
- B. Do not deliver or place topsoil in frozen, wet or muddy condition.
- C. Place topsoil in areas where seeding to thickness as scheduled. Manually spread topsoil close to trees, plants, site improvements, and buildings to prevent damage. Place topsoil during dry weather.
- D. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.
- E. Remove roots, weeds, rocks and foreign material while spreading.
- F. Lightly compact placed topsoil.
- G. Unless otherwise noted or indicated, compacted surface of placed topsoil shall be 1/2" below top of header boards, walks, pavements, and utility structures. Where upslope and against curb, flush with top of curb to allow positive drainage.
- H. All required topsoil (per schedule) shall be in place prior to any landscaping activities within the area to immediately receive landscaping.
- I. Leave stockpile area and site clean and raked, matching existing grade before placement of stockpile or proposed grade, as applicable, and ready to receive landscaping. Grade site surface to prevent free-standing surface water.

3.4 TOLERANCES

- A. Top of Topsoil: Plus or minus 1/2 inch (13 mm) adjacent to improvements; 1 inch (25 mm) within 100 feet of buildings and 2 inches (50 mm) on surrounding fields and slopes.

3.5 PROTECTION

- A. Section 01 70 00 – Execution Requirements: Protection of Completed Work.
- B. Comply with Section 31 10 00 – Site Preparation and Clearing: Protection.
- C. Protect landscaping and other features remaining as final work.
- D. Protect any/all existing site improvements including structures, fences, sidewalks, utilities, paving and curbs.

3.6 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Seeded Grass: 4 inches (100 mm) minimum.

END OF SECTION

SECTION 329219
SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, equipment and incidentals necessary to provide a complete installation of all tillage, pH balancing, fertilizing, seeding, and mulching of all disturbed areas within the Contract limits not occupied by structures, pavement or plantings, as indicated on the Drawings and specified herein.
- B. Topsoil testing.
- C. Erosion Control/Temporary Seeding.
- D. Permanent Seeding/complete stabilization with natural materials.
- E. Maintenance.
- F. Lawn guarantee.

1.2 REFERENCE STANDARDS AND QUALITY ASSURANCE

- A. All materials, preparations and workmanship shall be performed by experienced workmen regularly engaged in the work of this section. Seeding work shall be performed by a single firm specializing and experienced in landscape work.
- B. All products shall be applied or installed in strict conformance with the manufacturer's written instructions and acceptable trade practices.
- C. All products shall be labeled in accordance with the U.S. Department of Agriculture Rules & Regulations.
- D. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- E. Have topsoil classified and analyzed to determine nutritional requirements of soil for establishment of lawns.
- F. FS O-F-241D - Fertilizers, Mixed, Commercial.

1.3 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer composition.

1.4 DEFINITIONS

- A. Noxious Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass,

Wild Garlic, Perennial Sorrel, and Brome Grass.

- B. Satisfactory stand of grass: A dense, vigorous and well established cover of living grass of the specified mixture where no individual lawn area has unacceptable portions in excess of one percent of its area or gaps larger than a circle 4 inches in diameter.
- C. Establishment period: The establishment period for lawn areas shall be the time from installation until final acceptance, as determined by the Architect.

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedure.
- B. Soil analysis report: Testing will be at the Contractor's expense.
- C. Certification that imported topsoil is free from weeds.
- D. Certificates of inspection as required by governing authorities.
- E. Other data substantiating that materials comply with specified requirements.
- F. Manufacturer's or vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- G. All products identified in PART 2 of this specification.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01 70 00 - Execution Requirements: Contractor's Closeout Submittals to Architect.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- C. Guarantee and warranties.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 60 00 – Product Requirements.
- B. Fertilizer, soil amendments, and seed shall be delivered to the site in the original, unopened, undamaged containers bearing the manufacturer's guaranteed analysis, name, trade name, trademark, and statement of conformance to state and federal laws. Labels shall be intact and legible. In lieu of containers, fertilizer and soil amendments may be furnished in bulk with a certificate indicating the above information accompanying each delivery. All such certificates shall be submitted to the Architect to confirm quantities of materials used on project.
- C. During delivery and storage, seed, fertilizer, soil amendments, straw and matting

shall be kept in dry storage free from the effects of weather and away from contaminants. Should any material become wet or damaged, reject immediately and replace at no cost to the Owner.

- D. Precautions shall be taken to protect containers from rupture prior to use.

1.8 MAINTENANCE SERVICE

- A. Provide service and maintenance of seeded areas through establishment period (see definitions above).

1.9 INITIAL ACCEPTANCE

- A. Establishment of new lawn: Contractor shall be responsible for providing a finished lawn of a satisfactory stand of grass (see definitions above). Any areas which fail to show a satisfactory stand of grass shall be reworked and reseeded at the Contractor's expense with the same seed as originally used thereon until all required areas are satisfactorily covered.

1.10 GUARANTEE AND WARRANTIES

- A. Contractor shall guarantee all seeding work for a period of one (1) year. Guarantee period shall begin on the date of acceptance of the established lawn for the entire project, as determined by the Architect.
- B. Provide written warranties within thirty (30) days of final acceptance.

PART 2 PRODUCTS

2.1 SEED MIXTURE

- A. State-certified seed of the latest season's crop, labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws.
- B. All seed shall be Blue Tag Certified Seed with varieties strictly conforming to those listed on the Virginia Turfgrass Variety Recommendations, latest edition, published by Virginia Polytechnic Institute and State University.
- C. Permanent Seeding: Lawn areas shall be seeded with a mixture of 95-100 percent by weight (typ) improved or turf-type Fescue, 0-5 percent Bluegrass and 0-5 percent Ryegrass. The improved Fescue component shall be composed of three subspecies, each composing between 20 and 40 percent of the Fescue component. The Bluegrass shall be composed of equal parts of three subspecies. The Ryegrass component shall be of a single species of perennial ryegrass. Seed at 5-8 #/1000 square feet. Seeding shall be between April 1 and May 31, or August 15 and October 15.
- D. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.
- E. Erosion Control/Temporary Seeding: Refer to ESC Notes on the Drawings.

2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 31 05 13 – Soil Materials: Topsoil Materials.

2.3 ACCESSORIES

A. Straw Mulch Material:

1. Straw shall be stalks from oats, wheat, rye, barley or rice that are free from noxious weeds, chemicals, mold, decay or foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
2. Straw shall be in an air-dry condition suitable for placing. Straw supplied for mechanical application shall be chopped.

B. Wood Cellulose Mulch Material:

1. Mulch supplied for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood cellulose fiber. Wood cellulose fiber shall not be utilized however from 6/1 to 9/1 or 12/1 to 3/1. During this time, straw mulch shall be utilized.
2. Processing of wood cellulose fiber shall be in such a manner that it will not contain germination or growth inhibiting elements.
3. Wood cellulose fiber shall be dyed an appropriate color to allow visual metering of its application.
4. Wood cellulose fiber shall have the property of becoming evenly dispersed and suspended when agitated in water.
5. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover which readily absorbs water and allows infiltration to the underlying soil.
6. Weight specifications from suppliers and for applications shall refer to air dry weight of the fiber, a standard equivalent to 10 percent moisture.

- C. Binder for Mulch: Emulsified asphalt, ASTM D977-86, Grade SS-1.

- D. Fertilizer: Commercial fertilizer shall conform to all applicable state and federal regulations and be certified by the Virginia Department of Agriculture and Consumer services to be in accordance with the type and quantity of material indicated on the bag labels. For EC / temporary seeding, it shall have a minimum guaranteed analysis of 5 percent nitrogen, 10 percent phosphorus, and 10 percent soluble potash or approved equal. For permanent seeding, it shall have a minimum guaranteed analysis of 14 percent nitrogen, 20 percent phosphorus, and 14 percent soluble potash or approved equal.

E. Soil Amendments:

1. Lime: To pH balance soil, ground, natural, dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 20-mesh sieve.
2. Aluminum Sulfate: To pH balance soil, commercial grade in dry power form.
3. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

- F. Water: Potable.
- G. Mulch Stabilization Netting: Plastic or natural fiber netting used to prevent displacement of straw mulch, manufactured by:
 - 1. American Excelsior Co. - Erosion Control Netting
 - 2. Belton Industries - Soil Anti-wash/Geojute
 - 3. CONWED Fibers - Erosion Control Netting
- H. Re-vegetation Mats/Erosion Control Mats:
 - 1. Mats manufactured specifically to hold moisture without the additional use of mulch, and retard erosion, manufactured by:
 - 2. Re-vegetation Mats:
 - a. North American Green, Inc. - SC150 Blanket
 - b. American Excelsior Co. - Curlex Blanket
 - c. Gulf States Paper Corp. - Hold/Gro
 - d. CONWED Fibers - Futerra Revegetation Blanket
 - e. CONTECH Constr. Prod., Inc. - Excelsior Erosion Control Blankets
 - 3. Erosion Control Mats:
 - a. North American Green, Inc. - P350
 - b. Landlok - TRM 450
- I. Staples: Plain iron wire, No. 8 gauge or heavier, with a minimum in-ground length of 6 inches.
- J. Stakes: Softwood lumber, chisel pointed.
- K. String: Inorganic fiber.
- L. Landscape Fabric: 3.0 oz. Or better non-woven polyester, commercial weed restrictor fabric. UV stabilized
- M. Other Materials: All other materials, not specifically described but required for a complete and proper seeding operation, shall be selected by the Contractor and subject to the approval of the Architect.

2.4 TESTS

- A. Provide and pay for the services of a testing agency certified by the state to:
 - 1. Classify the topsoil in accordance with the Uniform Soil Classification System and provide percentages of sand, silt and clay.
 - 2. Perform an analysis of topsoil to be used, and make a determination of pH and nutritional requirements of the soil for establishment of lawns.
 - 3. Analyze fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit sample of fertilizer and topsoil proposed (one per source) to approved testing laboratory in sealed containers to prevent contamination. Sample size shall be as required by laboratory.

PART 3 EXECUTION

3.1 EXAMINATION / COORDINATION

- A. Series 01300 – Administrative Requirements: Coordination.
- B. Verify that prepared subsoil base and utility installation work is complete.
- C. Verify that Landscape Grading (topsoil material and depth) is complete, correct and ready to receive the work of this section.

3.2 EROSION CONTROL/TEMPORARY SEEDING

- A. Temporary seeding shall be applied to denuded areas within 7 days after final grade has been established, if season is improper for permanent seeding, and within 7 days to portions of the site which may not be at final grade but which will remain inactive for more than 30 days and less than one year. Lawn areas, athletic fields and slopes may be topsoiled and permanently seeded only if this can be accomplished during the correct time of year for the permanent seed mixture specified. Permanent Seeding is required for areas which will remain dormant for more than one year.
- B. Where the area is compacted, crusted or hardened, the soil surface shall be loosened by disking, raking, harrowing or other means.
- C. Apply lime at a rate of 50 pounds per 1000 sq. ft. and commercial fertilizer at 10 pounds per 1000 sq. ft. Thoroughly mix into loosened soil.
- D. Seed shall be evenly applied at a rate of 2 lbs. per 1000 sq. ft. to the prepared ground and mulched.
- E. Slopes greater than 3:1 shall be hydroseeded. Other areas may be hydroseeded or dry seeded at the Contractor's option.
- F. Hydroseeding operations shall include seed, fertilizer, mulch and binder in one operation. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.
- G. After mulching of dry seeded areas, mulch shall be stabilized using a liquid binder. Portions which continue to lose mulch due to wind or runoff shall be further stabilized with mulch stabilization netting. Install netting as specified herein.
- H. Areas which fail to establish vegetative cover adequate in checking erosion shall be re-seeded as soon as such areas are recognized.

3.3 PERMANENT SEEDING - GENERAL

- A. Seeding shall not be done when the ground is frozen, snow covered, saturated, or in any other condition which would make establishment and survival of lawns unlikely.
- B. At the time of beginning seed bed preparation, topsoil shall be in a loose, friable

condition, free from stones over 1" in any dimension, sticks, roots and other extraneous matter. If topsoil has become crusty, hardened or eroded since being spread, it shall be a part of this work to restore the soil to the loose condition described above.

- C. Prior to preparation of undisturbed areas, remove vegetation and debris and dispose of such material off-site; do not turn under into soil being prepared for seed bed. Loosen existing grade to a depth of 4", remove all debris which surfaces.
- D. Contractor shall hydroseed all slopes 3 to 1 or steeper. All other areas shall be dry-seeded or hydroseeded at the Contractor's option unless noted otherwise on the Drawings.

3.4 SEED BED PREPARATION:

- A. Work areas of 3 to 1 slope and less to a smooth even surface free from irregularities, ridges or depressions. Prepared areas shall meet required finish grade elevations and shall drain adequately.
- B. Areas greater than 3 to 1 slopes shall be left in a roughened state but meeting required finish grade elevations. Repair all washed and eroded portions.
- C. Spread fertilizer at the rate of 25 lbs. per 1000 sq. ft. or as recommended otherwise by the soil test report. Add pH balancing agents at rate recommended by soil test reports to achieve a pH of 6.0 to 7.0 for turf grass seeding. For vegetative cover other than turf grass, achieve the pH level best suited for that material as suggested by the testing agency. Under circumstances where it is not possible to obtain soil tests, apply lime at a rate of 100 lbs./1000 sq. ft. Blend additives thoroughly into upper 4" of topsoil.
- D. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- E. Blend additives thoroughly into upper 4" of topsoil. Remove any rock or other debris which may surface. Till areas until soil is loose and friable and all soil amendments are uniformly distributed.
- F. Moisten prepared areas if soil is dry. Water thoroughly, then allow surface moisture to evaporate. Do not create muddy soil conditions.

3.5 DRY SEEDING NEW LAWNS:

- A. Within 3 days of finish grading and seed bed preparation, sow seed using a spreader or seeding machine at the rate of 5 lbs. per 1000 sq. ft. Do not seed when wind velocity exceeds 5 mi. per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- C. Rake seed lightly into top 1/4" of soil, firm entire area with a roller not exceeding 90

lbs. per foot of roller width, and water with a fine spray.

- D. Unless indicated otherwise on the Drawings, protect newly seeded areas by spreading mulch to a uniform and continuous depth of 1/2" loose measurement (70-90 lbs./1000 sq. ft.). Anchor mulch by one of the following methods:
 - 1. Liquid mulch binder, applied at the rate of 10 gal. per 1000 sq. ft. Mask adjacent areas to prevent over-spray damage.
 - 2. Tractor-drawn mulch anchoring equipment, limit use to slopes 3:1 and less. Machinery shall be operated along the contour.
 - 3. Mulch stabilization netting.
- E. Install erosion control/re-vegetation mat in areas designated on the Drawings.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

3.6 HYDROSEEDING NEW LAWNS (Required for 3:1 and greater slopes)

- A. The slurry shall be prepared and applied to yield the following rates:
 - 1. Seed: 5 lbs. per 1000 sq. ft.
 - 2. Fertilizer: 25 lbs. per 1000 sq. ft.
 - 3. Mulch: 35 lbs. per 1000 sq. ft.
- B. Hydroseed mulch is to be an integral part of the slurry mix; it shall be added after the seed and fertilizer have been thoroughly mixed and shall be applied uniformly to all seeded areas.
- C. Areas which are hydroseeded from 6/1 to 9/1 or 12/1 to 3/1 shall be mulched with straw. Wood fiber mulch shall not be used during these times.

3.7 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches (300 mm). Space stakes at 10 feet max. (3 m).
- B. Cover seeded slopes where grade is 3H:1V or greater with re-vegetation mats.
- C. Place re-vegetation mats or erosion control mats in ditches where indicated on the Drawings.

3.8 NETTING/MAT PLACEMENT:

- A. Laying the Net/Mat:
 - 1. Start laying net/mat from top of swale/slope and unroll downgrade. Mat shall be placed minimum 12" beyond edges of swale and 18" beyond top and bottom of slopes.
 - 2. Allow to lay loosely on soil - do not stretch or pull.
 - 3. To secure: Upslope ends of net/mat should be buried in a slot or trench no less than 6 inches deep. Tamp earth firmly over net/mat. Staple every 12 inches across the top end.
 - 4. Edges shall be stapled every 3 feet. Where 2 strips are laid side by side,

the adjacent edges shall be overlapped 3 inches and stapled together.

5. Staples shall be placed down the center of net/mat strips at 3-foot intervals. DO NOT STRETCH when applying staples.
- B. Joining Strips: Insert new roll of net/mat in trench, as with upslope ends. Overlap the end of the previous roll 18 inches, turn under 6 inches, and staple across end of roll just below anchor slot and at the end of the turned-under portion every 12 inches.
- C. At Bottom of Slopes: Lead net/mat out onto a level area before anchoring. Turn ends under 6 inches, and staple across end every 12 inches.
- D. Provide 12 inch (300 mm) overlap of adjacent rolls. At sides of ditches, lay fabric laps in direction of water flow.
- E. Check Slots: On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 15 feet. Insert a fold into a 6-inch trench and tamp firmly. Staple at 12-inch intervals across the downstream portion.
- F. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- G. Rolling: After installation, net/mat should be rolled to ensure firm contact with soil.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD:

- A. The Contractor shall be responsible for all maintenance during the establishment period. This period may extend beyond the Date of Substantial Completion if lawns are not deemed acceptable at that time. Maintenance shall include watering, fertilizing, removal of straw mulch, weed eradication, mowing, trimming, clipping removal, the reconstruction of all areas failing to yield vital stands, and the reconstruction of all area damaged by erosion or other occurrence.
- B. Stands in lawn areas shall be mowed at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of height at any one mowing. Soil stability areas shall not be mowed.
- C. Neatly trim edges and hand clip where necessary.
- D. Immediately remove clippings after mowing and trimming.
- E. Water to prevent grass and soil from drying out with hoses and portable sprinklers in areas that do not receive water from irrigation. Contractor to regularly rotate location of portable sprinklers to ensure that no single area becomes saturated.
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- H. After the third cutting of the establishment period but prior to inspection by the Architect, lawn areas within the scope of this Contract shall be fertilized with a

mixture having 50% or more of the total nitrogen in a water insoluble form:

<u>Time of Application</u>	<u>lbs. Total Nitrogen per 1000 sq. ft.</u>
August 15 - Nov. 15	1-1/2 to 2
April 15 - June 15	1 to 1-1/2

3.10 LANDSCAPE FABRIC PLACEMENT: Place between soil and mulch in all mulched planted areas for weed control.

3.11 CLEAN-UP AND PROTECTION

- A. Keep pavements clean and work area in an orderly condition.
- B. Remove from the site, all equipment, surplus materials, debris, etc. resulting from the seeding work as herein specified.
- C. Protect seeded areas and materials from damage due to operations by other contractors, trades and trespassers. Maintain protection during installation and until final acceptance. Treat, repair or replace damaged seeded areas as herein before specified.

3.12 INSPECTION AND ACCEPTANCE:

- A. When establishment period is completed, Architect will, upon written request, make an inspection to determine acceptability.
- B. Work may be inspected for acceptance in sections agreeable to the Architect, provided all work for that section is complete.
- C. When inspected work is not acceptable, replace or remedy rejected work. Continue all applicable requirements of Contract until re-inspection and acceptance by the Architect.

3.13 GUARANTEE

- A. The Contractor shall be responsible for providing a finished lawn by Substantial Completion if possible. The Contractor shall produce dense, vigorous, well established lawns and shall maintain lawn areas until final acceptance of the work by the Owner. Any areas which fail to show a uniform stand of grass shall be reworked, and reseeded at the Contractor's expense with the same seed as originally used thereon, and such reseeded shall be replaced until all required areas are covered with a satisfactory stand of grass.
- B. Re-seeding of bare areas must be accomplished through mechanical means using a slit-seeder or a core aerator.
- C. Contractor's responsibility to maintain shall begin when work is begun and continue until maintenance program is accepted by Owner.

- D. In the event that treatment or replacement is made necessary as a result of damage caused by circumstances which are beyond the Contractor's control, and not due wholly or partially as a result of any act or omission by the Contractor, such treatment or replacement will be authorized by the Owner by Change Order in accordance with the General Conditions.

END OF SECTION

SECTION 331116
WATER MAINS AND SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Pipe and fittings for exterior water system including distribution main, domestic service and fire service, as applicable.
- B. Valves, fire hydrants, fire department connection, and domestic water hydrants.
- C. Bedding and compaction.
- D. Adjustment of existing utility structures to meet proposed work.
- E. Provide an approved, operational underground exterior water service and fire service piping system from five (5) feet outside the building through connection to existing system.

1.2 REFERENCES

- A. AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- C. AMERICAN WATER WORKS ASSOCIATION (AWWA)
- D. AMERICAN WELDING SOCIETY (AWS)
- E. FACTORY MUTUAL RESEARCH CORP. (FM)
- F. MANUFACTURERS' STANDARDS SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
- G. NATIONAL FIRE PREVENTION ASSOCIATION (NFPA)
- H. UNDERWRITERS LABORATORIES (UL)
- I. UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)
- J. VIRGINIA DEPARTMENT OF HEALTH (VDH)
 - 1. Virginia Department of Health (VDH) "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- K. SOILS
 - 1. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
 - 2. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch

- (457 mm) Drop.
3. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 4. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

L. COPPER

1. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASTM B32 - Solder, Metal.
4. ASTM B88 - Seamless Copper Water Tube.
5. AWS A5.8 - Brazing Filler Metal.

M. PVC

1. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, 120.
2. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).
3. ASTM D2672 - Bell-End Polyvinyl Chloride (PVC) Plastic Pipe.
4. ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
5. ASTM D2467 - Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
6. ASTM D2564 - Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
7. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.
8. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
9. ASTM D2855 - Making Solvent-Cemented Joints With Poly Vinyl Chloride (PVC) Pipe and Fittings
10. ASTM F402 - Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
11. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
13. UNI B3 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe Complying With AWWA C900.

N. DUCTILE IRON

1. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
3. ANSI/AWWA C110 - Gray Iron and Ductile Iron Fittings, 3 Inch Through 48 Inches, for Water and Other Liquids.
4. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Flanged Pressure Pipe and Fittings.
6. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
7. ANSI/AWWA C153 - Ductile-Iron Compact Fittings, 3 Inch Through 16 Inch,

- for Water and Other Liquids.
- 8. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
- 9. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
- 10. ASTM A48 - Gray Iron Castings.

O. PE PIPE

- 1. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2 inch through 3 inch, for Water
- 2. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

P. VALVES, ETC

- 1. ANSI/AWWA C500 - Gate Valves (Double Disc), 3 through 48 in NPS, for Water and Sewage Systems.
- 2. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
- 3. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.
- 4. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
- 5. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
- 6. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
- 7. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
- 8. MSS SP80 - Bronze Gate, Globe, Angle and Check Valves.
- 9. MSS SP71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- 10. UL 246 - Hydrants for Fire - Protection Service.

Q. FIRE SERVICE

- 1. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."
- 2. NFPA 13, "Standard for the Installation of Sprinkler Systems."

1.4 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. All products identified in PART 2 of this specification.
- C. Manufacturer's Certificate: Certify that above referenced products meet or exceed specified requirements.
- D. Submit NFPA "Contractor's Materials and Test Certificate for Underground Piping." Use NFPA 13 Version with Owner Representative signature block.

1.5 PROJECT RECORD DOCUMENTS

- A. Record actual locations of piping mains, valves, connections per the As-Built Survey requirements of Specifications 31 10 00 – Site Preparation and 31 22 13 – Rough Grading.

- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Certify in writing to the Owner and to the Architect that the "System" has been approved and is ready for use.
- D. Maintenance Data: Submit maintenance data and parts list for the fire water system materials and products.

1.6 QUALITY ASSURANCE

- A. Code Compliance: Comply with:
 - 1. VDH Waterworks Regulations,
 - 2. Local water system standards and specifications,
 - 3. Local Fire Department/Marshal Regulations or Standards: Comply with governing regulations pertaining to hydrants, including hose coupling threading and matching of connections, and
 - 4. Owner's Insurance Company requirements.
- B. Install fire water systems in accordance with NFPA 24.
- C. Valves: Manufacturer's name and pressure rating shall be marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 – Product Requirements: Deliver, store, protect and handle products to site: Material & Equipment.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 PIPE & FITTINGS (4" & larger)

- A. Ductile Iron Pipe (buried applications): AWWA C151/ANSI 21.51, minimum thickness Class 51 with a minimum working pressure of 250 psi.
 - 1. Fittings: Ductile or grey iron, AWWA C110/ANSI 21.10 with a pressure rating not less than the pipe or AWWA C153/ANSI A21.53 with a working pressure of not less than that of the pipe.
 - 2. Joints: Mechanical joints per AWWA C111.
 - a. Bituminous Coating & Cement Lining: AWWA C104, Standard thickness for pipe and fittings.
 - b. Examples Meeting the Criteria or 1-3 above include, but are not necessarily limited to:
 - 1. Clow Super Bell-Tite Push-on Joint Ductile Iron Pipe.
 - 2. Pipe Tyton (Push-on) Joint Ductile Iron Pipe.
 - 3. Griffin Super Bell-Tite Push-on Joint Ductile Iron Pipe.
- B. Ductile Iron Pipe (non-buried applications): AWWA C-151/ANSI 21.51, minimum thickness Class 53.
 - 1. Cement Lining: AWWA C104, Standard thickness, for pipe and fittings.

2. Joints: AWWA C115 flanges or AWWA C606 grooved and shouldered joints. Provide flange joints with AWWA C111 full faced rubber gaskets for each flange in piping. Provide flanges, connection pieces, transition gaskets, transition sleeves and other adapters as required to complete the piping installation.
 3. Fittings:
 - a. AWWA C110/ANSI 21.10 (flanged), or AWWA C606 (grooved & shouldered) and pressure rating not less than the pipe.
 4. Grooved and shouldered joints shall be as manufactured by Victaulic Company of America of Easton, Pennsylvania or approved equal. The supplier of the grooved and shouldered joints shall be a factory certified representative of this piping system.
- C. PVC Pipe (4" - 12"): ANSI/AWWA C900 pressure Class 150 (DR18) with ductile iron pipe equivalent OD.
1. Joints: ASTM D3139 push-on or ASTM D3139 and AWWA C111 compression type mechanical joints, as applicable. ASTM F477 gaskets for push-on joints for pipe and AWWA C111 gaskets for push-on joints and mechanical joints for joint connections between pipe and metal fittings, valves, and accessories.
- D. Examples Meeting the above Criteria include, but are not necessarily limited to:
1. Johns-Manville Blue Brute PVC Water Pipe, DR18, Class 150
 2. Johns-Manville PVC Class Water Pipe, DR18, Class 150
 3. Clow Super Main 900 Water Main, DR18, Class 150
 4. CertainTeed Vinyliron Pipe, DR18, Class 150
 5. National C900 Pipe, DR18, Class 150
 6. Extrusion Technologies Inc. (ETI) C900, DR18, Class 150
- E. Fittings: ANSI/AWWA C110, ductile iron, with a pressure rating not less than the pipe and AWWA C104 standard thickness cement lining.

2.2 PIPE & FITTINGS (smaller than 4-inch diameter)

- A. Copper Tubing (for water piping only): ASTM B88, Type K:
1. Fittings:
 - a. ANSI/ASME B16.18, cast copper and brass, solder joint fittings, or
 - b. ANSI/ASME B16.22, wrought copper, solder joint fittings.
 2. Joints:
 - a. ASTM B32, 95-5 tin antimony solder, or
 - b. Plumbing Code approved lead free solder, or
 - c. Compression connection, as applicable.
- B. Polyvinyl Chloride (PVC) Pipe: ASTM D2241, SDR-21 (200 psig rated).
1. Joints: ASTM F477 rubber gaskets for push-on pipe.
 2. Pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service.
 3. Pipe and fittings shall be of the same PVC material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 2120/PVC II; PVC 2116/PVC II.
 4. Examples Meeting the above Criteria include, but are not necessarily limited

to:

- a. Johns-Manville Ring-Tite PVC Pressure Pipe (D2241) Bell & Spigot
- b. Clow PVC Bell-Tite Pressure Rated Pipe (D2241) Bell & Spigot

- C. Polyethylene Pipe: AWWA C901 ASTM D3035, with outside Dimension Ratio (DR) of 11.
 - 1. Joints: Butt fusion.
 - 2. Fittings: AWWA C901, molded.

2.3 INSULATING JOINTS

- A. Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent sections of piping.

2.4 BALL VALVES - Up to 2 Inches (50 mm)

- B. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, [AWWA] [IPS] [compression] inlet end, [compression] [IPS] outlet [with electrical ground connector], with control rod, extension box [and valve key].

2.5 GATE VALVES - Up to 3 Inches (75 mm):

- A. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.

2.6 GATE VALVES - 3 Inches (75 mm) through 14 Inches (350 mm)

- A. UL/FM Rated, Iron or ductile iron body, bronze trim, non-rising stem with square nut, single wedge, rubber encapsulated resilient seat, mechanical joint ends, control rod, available as post indicator, extension box and valve key. ANSI/AWWA C509 except with wall thicknesses exceeding the min. requirements of AWWA C153.
 - 1. Valves shall have a double O-ring stem seal, a minimum stem diameter of 7/8 inch for valves larger than six (6) inches, and shall open left (counter-clockwise).
 - 2. Valves shall be designed for a working pressure not less than that specified for the connecting pipe.
 - 3. Valves shall be coated inside and out with a fusion bonded epoxy coating meeting AWWA C550.
 - 4. Valves for above ground mounting or installed in vaults shall have flanged ends.
 - 5. Valves for buried installation shall have mechanical joints conforming to AWWA Std. C111 unless otherwise specified.
 - 6. Gate valves shall be supplied from a single manufacturer.
 - 7. Supply post indicator where indicated on the Drawings or as required by NFPA 24. Provide signage indicating "PIV" in 6-inch reflective white letters with red background and "STREET ADDRESS" IN 2-inch reflective white letters on red background.

2.7 SWING CHECK VALVES (smaller than four inches)

- A. MSS SP80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP71, Class 125.

2.8 SWING CHECK VALVES (4 inches to 24 inches (100 mm to 600 mm))

- A. Check valves shall conform with the specifications in ANSI/AWWA Standard C508. Valves shall be iron body, bronze trim, [45] [22] degree swing disc, renewable disc and seat, flanged ends. Valves shall be equipped with an outside weighted arm. Provide piston type anti-slam device on all check valves where indicated.

2.9 FIRE DEPARTMENT CONNECTIONS (FDC)

- A. Provide 90-degree cast brass siamese connections and sleeve assembly, with two 2-1/2 inch fire department inlet female hose connections, NST threads or per local fire dept. requirements, and self closing brass double clapper valves. Provide rough brass covers with chains. Acceptable FDC manufacturers include but are not limited to:
 - 1. Allen Manufacturing Div.
 - 2. Moon, Inc.
 - 3. Croker-Standard Div.
 - 4. Fire-End & Croker Corp.
 - 5. Elkhart Brass Mfg. Co., Inc.
- B. Signage: Provide signage indicating "FDC" in 6-inch reflective white letters with red background and "STREET ADDRESS" IN 2-inch reflective white letters on red background

2.10 FIRE HYDRANTS

- A. Hydrant: Type as required by Bedford Regional Water Authority Master Specifications, FH-1.
- B. Examples meeting the above criteria include:
 - 1. AMERICAN-DARLING VALVE
 - 2. Mueller
 - 3. Kennedy
- C. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- D. Hose and Pumper/Steamer Connections: Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection per utility company requirements. Nozzle threads shall be National Standard.
- E. Operating nut shall be National Standard, pentagon shape (1.5" point to flat) and turn counter-clockwise to open unless otherwise required by local utility company.
- F. Finish: Two coats of primer and two coats of enamel to color required by utility company. The hydrant body, bonnet, hose nozzles, pumper nozzle and caps shall

be painted silver. The side caps and/or bonnets shall be color coded by the BRWA at a later date based on the NFPA color coding system. Contractor shall verify ALL paint colors with the Bedford Regional Water Authority.

2.11 Provide reflective tape just below the bonnet of the hydrant upon installation and after the entire hydrant has been painted. WATER VAULTS

- A. Domestic Meter Vault per BRWA M-1.
- B. Fire Flow Meter Vault per BRWA FM-1.
- C. Fire Department Connection Vault: Precast or Cast-in-place. See detail on Drawings.

2.12 ACCESSORIES

- A. General: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required for a complete and operational system.
- B. Structure top adjustments: Provide grade rings, brick and mortar, or extensions as required for adjusting structure top elevations to meet proposed finish grades.
- C. Thrust Block/Anchorages: Provide at all tees, wyes, crosses, plugs, caps, bends, valves and hydrants.
- D. Valve Box: Each valve on buried piping shall be provided with an adjustable cast-iron valve box of a size suitable for the valve. Provide each cast-iron box with a heavy coat of bituminous paint. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the box shaft shall be 5.25 inches.
- E. Trace Wire for Non-Metallic Piping: Comply with Section 31 23 17 - Utility Trenching & Backfilling.
- F. Buried Utility Warning and Identification Tape: Comply with Section 31 23 17 - Utility Trenching & Backfilling.
- G. Identification Tags and Plates: Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or non-ferrous metal and shall be mounted or attached to the valve.
- H. Rim Adjustments: Provide pre-cast grade rings or install brick and mortar as necessary to level, raise or lower existing or new manhole frames and covers to meet finish grade. Adjustments of 8 inches or less in height shall not be considered for additional compensation.

2.13 BEDDING MATERIALS

- A. Bedding & Haunching: Coarse Aggregate Type A1 (Utility Bedding, Select Backfill) as specified in Section 31 05 16 - Aggregate Materials.
- B. Cover Bedding/Initial Backfill: Soil Type S1 or S2 as specified in Section 31 05 13 - Soil Materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Coordinate with the BRWA for all required meetings, inspections, and approvals.
- B. Verify that building service connection, point of water service connection and municipal utility water main size, location and invert are as indicated.
- C. Verify that grades are within six (6) inches of finished subgrade prior to the commencement of this work. Minimum clear cover over all water pipe shall be three (3) feet.
- D. Inspect all new water piping material upon receipt and immediately prior to installation to verify that it is in acceptable condition and proper working order. Mark all damaged material, remove it from the site at the first opportunity and replace it promptly so the work will not be delayed.
- E. For new and existing water utilities affected by new work, verify that structure top elevations have been adjusted to meet proposed finished grades.

3.2 PREPARATION

- A. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, valves, or any other water piping material.
- B. Have all necessary arrangements made to complete the work and place it in operation without delays.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 SEPARATION

- A. Water Piping Installation Parallel to Sewer Piping
 - 1. Normal Conditions: Water piping shall be laid at least ten (10) feet horizontally from a sewer or sewer manhole wherever possible, measured edge to edge.
 - 2. Unusual Conditions: When local conditions prevent ten (10) feet horizontal separation, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - a. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
 - b. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - c. The sewer manhole shall be of water-tight construction and tested in place.
- B. Water Piping Installation Crossing Sewer Piping
 - 1. Normal Conditions: Water piping crossing above sewer piping shall be laid

to provide a separation of at least 18 inches above the top (crown) of the sewer piping.

2. Unusual Conditions: When local conditions prevent the vertical separation described above, the following construction shall be used:
 - a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - b. Water piping passing under sewer piping shall, in addition, be protected by providing the 18 inch vertical separation described above, adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping, and that the length (min. 18 feet) of the water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.

C. Sewer Manholes

1. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 - Utility Trenching & Backfilling for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated. See Drawings for trench detail.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches (150 mm) compacted depth, compact to 95 percent. Continue until pipe springline elevation is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 INSTALLATION - PIPE

- A. Connection to Existing Water Systems: Connection to existing system will be made by the Contractor and coordinated with the Western Virginia Water Authority. Use tapping and drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the sleeve. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Owner in writing at least fifteen (15) days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials and labor required to make connections into the existing water supply systems.
- B. The Contractor shall be responsible for all public notification of service interruptions of the water main. Comply with all WVWA requirements regarding safety, temporary services and installation procedures.

- C. The Contractor shall comply with the Waterworks Regulations pertaining to separation of water and sanitary sewer.
- D. Establish elevations of buried piping to ensure not less than 3 ft (900 mm) of cover.

3.6 UTILITY ADJUSTMENT

- A. Adjust the tops of all affected water utility structures whether new or existing to meet finished grades. Provide grade rings, brick and mortar, or extensions for existing or new structures such that tops meet proposed finish grades. Adjustments of 8 inches or less in height shall be made at no additional cost to the Owner.
- B. Coordinate timing of adjustment work to be prior to stone base applications for paved areas and prior to topsoil applications in lawn spaces.

3.7 DUCTILE IRON

- A. Install ductile iron piping and fittings in accordance with ANSI/AWWA C600.

3.8 POLY-VINYL CHLORIDE (PVC)

- A. Install PVC piping and fittings to ASTM D2774.
- B. Inspect pipe, fittings, valves, and accessories before and after installation; those found defective shall be replaced with new materials. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- C. Route pipe in a straight line, unless otherwise indicated on the Drawings. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
- D. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- E. Install pipe to indicated elevations and grade to within tolerance of 5/8 inch (20 mm). Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with wood blocks or bulkheads.
- F. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfection of Water Distribution System. Position drains at low points.

- G. Conduct testing.
- H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, vertical and horizontal, and behind fire hydrant as recommended by manufacturer. See detail on the Drawings.
- I. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 31 23 17 - Utility Trenching & Backfilling.
- J. Place cover bedding/initial backfill to depth indicated in trench section on the Drawings, compacted to 95%.
- K. Backfill pipe trench in accordance with Section 31 23 17 - Utility Trenching & Backfilling for work of this Section.

3.9 SPECIAL REQUIREMENTS FOR INSTALLATION OF DISTRIBUTION PIPING

- A. Ductile Iron Pipe and Fittings:
 - 1. AWWA C600 for pipe installation, joint assembly, valve and fitting installation, and thrust restraint, except as otherwise specified hereunder. Provide AWWA C600 joint assembly for push-on joints. Provide AWWA C600 joint assembly for mechanical joints and with the recommendations of Appendix A to AWWA C111. Make flanged joints up tight; avoid undue strain on flanges, fitting, valves, and other accessories. Use full-sized bolts for the bolt holes; use of the undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overtraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Assure that there is no metal-to-metal contact between dissimilar metals after joint has been assembled.
- B. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - 1. UNI B3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings, except as specified hereunder. Make push-on joints with elastomeric gaskets using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. Use push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - 2. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UNI B3 for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories with the requirements of AWWA C600 for joint assembly. Assemble compression-type joints and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners in accordance with the requirements of UNI B3 and AWWA C600, and Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint and mechanical-joint connections and

do not re-bevel.

C. Pipe Anchorage:

1. Provide anchorage of buried piping shall be installed at all 22.5 degrees and sharper bends, and tees. Dead ends of piping shall be securely blocked in the direction of flow.
2. Provide reaction anchors of concrete blocking, metal harness, retainer gland type, or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on the Drawings.
3. Use of metal harness restraints shall be approved by the Engineer.
4. Concrete thrust blocks (reaction backing) shall have a minimum compressive strength of 3000 psi. Dead ends restrained with concrete shall have the concrete bearing solidly against the piping and affording a minimum of 3 square feet of bearing area against a vertical trench face (undisturbed earth) for 3- and 4-inch piping, and in accordance with the drawing details for piping 6-inch diameter and larger.

3.10 SETTING OF VALVES AND VALVE BOXES

A. Valve, Air Release, Meter and Blow-Off Chambers (as applicable):

1. Drain to municipal stormwater system where provided. Where not provided, drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
2. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on the Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.
3. Equip all underground valves without gearing or operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground or pavement surface.
4. Valve, Air Release, Meter and Blow-Off Chambers
 - a. Drain to surface where not subject to flooding by surface water or to absorption pit located above seasonal water table elevation per Waterworks Regulations Section 3.53 C, otherwise to manufacturer's recommendation.
 - b. Provide chambers/boxes in accordance with manufacturer's recommendations and of adequate size to permit ease of access and maintenance.

3.11 SPECIAL REQUIREMENTS FOR INSTALLATION OF WATER SERVICE PIPING

A. Metallic Piping:

1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of AWWA C600 for pipe installation, except as otherwise specified in the following paragraphs.

B. Joints for Copper Tubing:

1. Cut copper tubing with square ends; remove fins and burrs. Replace dented, gouged, or otherwise damaged tubing with new tubing. Before making joint, clean ends of tubing and interior of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and then flare tubing with flaring tool.
- C. Flanged Joints:
1. Make flanged joints up tight; avoid undue strain on flanges, valves, fittings, and accessories.
- D. PVC Piping
1. Install pipe and fittings in accordance with the general requirements for installation of piping and with the applicable requirements of ASTM D2774 and ASTM D2855, except as modified herein. ASTM F402 for safe handling of solvent cements.
 2. Jointing
 - a. Make solvent-cemented joints and assemble in accordance with ASTM D2855. Make pipe joints to other pipe materials in accordance with the recommendation of the PVC pipe manufacturer, as approved.
- E. Installation of Valves and Valve Boxes:
1. Valves and valve boxes shall be set plumb, with valve boxes centered directly over the valves. Valve boxes shall be located outside the area of the roads and streets whenever possible. Earth fill shall be tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Clean foreign matter from interior of valves before installation. Stuffing boxes shall be tightened and the valve shall be inspected in open and closed positions to ensure that all parts are in proper working order.
 2. Install a full-ported shut-off valve below each Air Release or Combination Air Valve in the event servicing is required.

3.12 INSTALLATION - FIRE HYDRANT ASSEMBLIES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade. The Contractor shall locate and uncover all valve boxes after pavement/surface treatment of roads and adjust the tops to final road grades, if necessary.
- C. Set Fire Department Connection (FDC) plumb and locate centerline of nozzles perpendicular to roadway.
- D. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.
- E. Set hydrants to grade in accordance with manufacturer's recommendations, with nozzle centers at least 20 inches (500 mm) above ground.

- F. Locate control valve 4 inches (100 mm) minimum away from hydrant.
- G. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inch (50 mm) diameter washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- H. Paint hydrants in accordance with requirements of BRWA and local fire department.

3.13 FIELD TESTS AND INSPECTIONS OF WATER MAINS

- A. Perform all field tests, and provide all labor, equipment, and incidentals required for testing and approval by BRWA. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.
- B. Field Testing of System:
 - 1. The Contractor may backfill over the pipe as laid, except as noted below. The bell holes shall either be left open or reopened for a visual inspection of the joints during the test period. The bell holes of all dry joints may be backfilled following this test. All leaking joints shall be reconnected (or tightened as necessary) and retested and all pipe, valves and fittings and other materials found defective under this test shall be removed and replaced at the Contractor's expense.
 - 2. Exception: When the open trench or open bell holes necessary for a visual inspection and test of the joints present a hazard to safety and welfare, or in an emergency, and/or special case, the operation incident to trenching, pipe laying, backfilling and testing shall be so coordinated as to minimize the lineal footage of open trench and that portion of the system tested in accordance with this section.
 - 3. This portion or portions of the system shall be tested between valves or temporary plugs in sections of not more than 2,500 lineal feet.
- C. Pressure and Leakage Test:
 - 1. Test Restrictions and Certification:
 - a. Per "Contractor's Material and Test Certificate for Underground Piping" following this section.
 - b. Test pressure shall not vary by more than +/-5 psi for the duration of the test.
 - c. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.
 - d. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed,

resilient-seated gate valves or butterfly valves.

D. Pressurization:

1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to the required hydrostatic pressure at the point of testing to provide the minimum required pressure at the high point in the test section. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the evaluation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

E. Air Removal:

1. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

F. Examination:

1. All fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

G. Flushing: Per Test Certificate unless test section is a fire service line, then flushing shall be in accordance with NFPA 24.

H. Leakage Defined

1. See Test Certificate.

I. Allowable Leakage

1. See Test Certificate.

J. When hydrants are in the test section, the test shall be made against closed hydrant valves.

K. Acceptance of Installation:

1. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe disclosed leakage greater than that specified in Paragraph "H" above, the contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance.
 - a. All visible leaks are to be repaired, regardless of the amount of leakage.

3.14 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00 -Disinfection of Water Distribution System.

3.15 SERVICE CONNECTIONS

- A. Provide all sleeves, caulk or other materials required to provide a watertight connection at buildings or through walls or foundations.

3.16 FIELD QUALITY CONTROL

- A. Field trench inspection and compaction testing shall be performed under provisions of Section 31 23 17 - Utility Trenching & Backfilling.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D698 Standard Proctor. Field testing methods shall be as deemed appropriate by the Geotechnical Engineer.
- C. Installation and testing shall be inspected in accordance with Section 31 09 00 – Geotechnical Engineering, Inspections & Testing
- D. Disinfection testing shall be performed in accordance with Section 33 13 00 - Disinfection of Water Distribution System.
- E. All equipment shall be tested in operation to demonstrate compliance with the contract requirements.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

Contractor's Material and Test Certificate for Underground Piping	
PROCEDURE Upon completion of work, inspection, and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job. A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.	
PROPERTY NAME	DATE
PROPERTY ADDRESS	
PLANS	ACCEPTED BY APPROVING AUTHORITIES (NAMES)
	ADDRESS
	INSTALLATION CONFORMS TO ACCEPTED PLANS <input type="checkbox"/> YES <input type="checkbox"/> NO EQUIPMENT USED IS APPROVED <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, STATE DEVIATIONS
INSTRUCTIONS	HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF THIS NEW EQUIPMENT? IF NO, EXPLAIN <input type="checkbox"/> YES <input type="checkbox"/> NO
	HAVE COPIES OF APPROPRIATE INSTRUCTION AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES? IF NO, EXPLAIN <input type="checkbox"/> YES <input type="checkbox"/> NO
LOCATION	SUPPLIES BUILDINGS
UNDERGROUND PIPES AND JOINTS	PIPE TYPES AND CLASS TYPE JOINT
	PIPE CONFORMS TO _____ STANDARD <input type="checkbox"/> YES <input type="checkbox"/> NO FITTINGS CONFORM TO _____ STANDARD <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, EXPLAIN
	JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN ACCORDANCE WITH _____ STANDARD <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, EXPLAIN
TEST DESCRIPTION	<p>FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags and outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.</p> <p>HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.</p> <p>LEAKAGE: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal sealed valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz. per minute (150 mL/min) leakage is permitted for each hydrant.</p>

Figure 8-1 (b) Part 1.

FLUSHING TEST	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARDS BY (COMPANY) <input type="checkbox"/> YES <input type="checkbox"/> NO IF NO, EXPLAIN _____		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> HYDRANT BUTT <input type="checkbox"/> OPEN PIPE
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY) IF NO, EXPLAIN _____ <input type="checkbox"/> YES <input type="checkbox"/> NO		
	HOW FLUSHING FLOW WAS OBTAINED <input type="checkbox"/> PUBLIC WATER <input type="checkbox"/> TANK OR RESERVOIR <input type="checkbox"/> FIRE PUMP		THROUGH WHAT TYPE OPENING <input type="checkbox"/> Y.CONN TO FLANGE & SPIGOT <input type="checkbox"/> OPEN PIPE
HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		JOINTS COVERED <input type="checkbox"/> YES <input type="checkbox"/> NO
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS _____ HOURS		
	ALLOWABLE LEAKAGE _____ GALS _____ HOURS		
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY <input type="checkbox"/> YES <input type="checkbox"/> NO
	WATER CONTROL VALVE LEFT WIDE OPEN IF NO, STATE REASON _____		<input type="checkbox"/> YES <input type="checkbox"/> NO
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS <input type="checkbox"/> YES <input type="checkbox"/> NO INTERCHANGEABLE WITH THOSE OF THE FIRE DEPARTMENT ANSWERING ALARM		
REMARKS	DATE LEFT IN SERVICE _____		
SIGNATURES	NAME OF INSTALLING CONTRACTOR _____		
	TESTS WITNESSED BY		
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE
ADDITIONAL EXPLANATION AND NOTES			

Figure 8-1 (b) Part 2.

END OF SECTION

SECTION 331300
DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not necessarily limited to)

- A. Disinfection of all equipment, pipe lines, and all structures in the water project with which water comes in contact and/or which have been contaminated by the Contractor's operations shall be accomplished after completion of construction and immediately before the system or unit is placed in operation.
- B. Testing and reporting results.

1.2 REFERENCES

Bedford Regional Water Authority (BRWA)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- A. VDH "Waterworks Regulations," latest edition, hereinafter Waterworks Regulations.
- B. ANSI/AWWA B300 – Standard for Hypochlorites.
- C. ANSI/AWWA B301 – Standard for Liquid Chlorine.
- D. ANSI/AWWA B302 – Standard for Ammonium Sulfate.
- E. ANSI/AWWA B303 – Standard for Sodium Chlorite.
- F. AWWA C651 – Standards for Disinfecting Water Mains.
- G. ANSI/AWWA C652 – Standards for Disinfecting Water Storage Facilities.

1.3 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of applicable of Division 01: Contract Closeout: Project Record Documents, Requirements.
- B. Disinfection report; record:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm

- for each outlet tested.
- 5. Date and time of flushing start and completion.
- 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report; record:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of VDH Waterworks Regulations.
 - 8. Bacteriologist's signature and authority.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS & DILUTION MEDIUM

- A. Disinfecting Agent: The disinfection agent shall be liquid chlorine ANSI/AWWA B301, or sodium hypochlorite solution ANSI/AWWA B303. Dry hypochlorite ANSI/AWWA B300, similar and equal to "HTH" may also be used as the disinfecting agent.
- B. Potable water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Piping shall be cleaned immediately after placing and all open ends shall be adequately sealed to prevent entry of debris.
- B. Unless the Contractor adheres to AWWA C651 concerning pipe cleanliness and prevents contamination of pipe, fittings and valves during construction, disinfection will be difficult.
- C. All sediment and foreign matter including debris resulting from cutting, welding or fabrication shall be removed from entire water distribution system including water lines and hydrants, followed by thorough flushing with potable water at a minimum velocity of 3 ft/sec to remove any sediment which may have collected during operation with raw water. In cases where this velocity is not attainable or is ineffective, cleaning devices such as foam swabs or "pigs" will be considered.

- D. Perform scheduling and disinfection activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Pressure Testing: After the valves and piping have been installed, they shall be subjected for one hour to a hydrostatic pressure test of 150 pounds per square inch at the points of reading when the system is put into operation. Any defective material shall be replaced by the Contractor with sound material.
- C. Disinfection: All water lines shall be disinfected prior to being placed in operation. Potable water shall be introduced into the pipe line 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. An approved hypochlorite solution injected by a metering pump or liquid chlorine injected by a solution-feed chlorinator and booster pump may be used. The chlorine shall be added long enough to ensure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The Chlorine residual shall be checked at regular intervals not to exceed 2000 feet to ensure that adequate residual is maintained. As the chlorinated water passes valves and other appurtenances, they shall be operated to ensure disinfection of these appurtenances.

After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water until chlorine measurements show a concentration no greater than that generally prevailing in the source system. Comply with AWWA C651 requirements for disposal of disinfecting water with high chlorine concentrations.

After flushing the waterlines, two series of bacteriological samples shall be taken 24 hours apart. Collect one set of samples at intervals of 1,200 ft. of waterline, plus one set at each end of the new line and at the end of each branch (minimum of three sets total). Sets of two consecutive biological samples, taken at least 24 hours apart, which show no contamination, will indicate acceptable disinfection and the water lines may be placed in service.
- D. Disinfect permanent system devices removed for system disinfection by exposing to a chlorine solution for a similar time period (method shall be approved in the field). Replace same devices, being sure not to contaminate in the process.

3.3 QUALITY CONTROL

- A. Submit under provisions of applicable section of Division 01: Quality Control or Testing Laboratory Services: Testing water samples. Field inspection and testing.
- B. Test samples in accordance with AWWA C651.
- C. Approval of Disinfection: The complete disinfection program and methods followed, especially if materially different from those specified, shall be in accordance with directives of VDH and all methods employed shall have the approval of VDH. Definite instructions as to the collection and shipment of samples shall be requested from VDH and shall be followed in all respects. Final approval of the bacterial samples shall be received from VDH prior to the time that water mains are placed in service and allowed to be used for distribution of potable water. The Contractor shall deliver copies of the approved test data for the Owner and the Engineer.
- D. All references made above to VDH shall also apply to the local utility purveyor, as applicable.

END OF SECTION

SECTION 333100
SITE SANITARY GRAVITY SEWER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Sanitary gravity sewerage piping, fittings and accessories, and bedding.
- B. Connection of building sanitary drainage system to municipal sewer.
- C. Cleanout access and manholes.
- D. Utility top elevation adjustment.
- E. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein from approximately five (5) feet outside building walls.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Latest revision shall be assumed.

AMERICAN SOCIETY OF TESTING & MATERIALS (ASTM)

- B. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- C. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- D. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

- G. UNI B5 - Installation of Polyvinyl Chloride (PVC) Sewer Pipe
- H. UNI B6 - Low Pressure Air Testing of Installed Sewer Pipe

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- I. VDOT - Virginia Department of Transportation "Road & Bridge Standards & Specifications"

VIRGINIA DEPARTMENT OF HEALTH (VDH)

- J. VDH - Virginia Department of Health "Sewage Conveyance and Treatment (SCAT) Regulations."
- K. VDH - Virginia Department of Health "Sewage Handling and Disposal (SH&D) Regulations."
- L. VDH – Virginia Department of Health "Waterworks Regulations."

1.3 QUALITY ASSURANCE

- A. Qualifications of Installers: Use skilled and experienced workmen to ensure proper installation of the products specified herein. Workmen shall be thoroughly familiar with codes covering work of their trade and work to be performed under this contract. In the acceptance or rejection of installed Work, no allowance shall be made for the lack of experience on the part of the workmen.
- B. Comply with all standards specified in this Section.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Submittals.
- B. Manufacturer's Product Data:
 - 1. Provide manufacturer's standard drawings or catalog cuts for pipe, pipe accessories, and fittings.
 - 2. Provide manufacturer's drawings for metal work.
 - 3. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within three years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project. Include:
 - 1. Pipe and fittings, including factory applied linings,
 - 2. Pipe joint materials,
 - 3. Cast iron frames and covers,
 - 4. Precast concrete manhole sections.

1.5 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to the site for damage; store with

minimum of handling, on site in enclosures or under protective covering and not directly on the ground. Store plastic piping, jointing materials and rubber gaskets out of direct sunlight. Keep inside of pipes and fittings free of dirt and debris.

2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs or replace. Carry, do not drag, pipe to the trench.
- C. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of other trades.
- D. Damage: in the event of damage, immediately make all repairs and replacements necessary to the approval of and at no additional cost to the Owner or Engineer.

1.6 PROJECT RECORD DOCUMENTS

- A. Record location of pipe runs, connections, manholes, cleanouts, structure top elevations and all pipe invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities (active or abandoned).

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section. Conform to materials' manufacturer's installation recommendations. Code shall take precedence.
- B. The Contractor shall comply with the VDH Waterworks Regulations Section pertaining to separation of water and sanitary sewer. Comply also with VDOT Std. UB-1 where separation requirements cannot be maintained.

1.8 COORDINATION

- A. Verify that field measurements and elevations are as indicated.
- B. Coordinate the Work with earthwork, trenching, point of connection to building sanitary plumbing, and connection to municipal sanitary sewer.
- C. Assure that structure tops will be at proposed finish grade and slope and that pipe cover is as specified.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Gravity Sewer Pipe & Fittings (12" and less in diameter with 10' max. bury): Conform to ASTM D3034, Type PSM, Poly-Vinyl Chloride (PVC) material, SDR-35; inside nominal diameter as indicated on Drawings. Examples meeting design criteria:
 - 1. National Pipe Company, PVC Sewer Pipe (SDR 35),
 - 2. Robintech, King's Joint PVC Sewer Main (SDR-35),
 - 3. Clow, Deflec-Tite PVC Sewer Pipe (SDR-35), or
 - 4. Approved equal.
- B. Joints: Bell and spigot type suitable for elastomeric gasket joints conforming to ASTM D3212.
- C. Gaskets: Conform to ASTM F477.

2.2 PIPE ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or provide mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required and with gaskets conforming to ASTM F477.

2.3 CLEANOUTS

- A. Per detail(s) on Drawings.

2.4 BEDDING & BACKFILL MATERIALS

- A. See Section 31 23 17 - Utility Trenching & Backfilling for:
 - 1. Bedding & Haunching,
 - 2. Cover Bedding/Initial Backfill, and
 - 3. Backfill Materials.

2.5 CONCRETE MATERIALS

- A. Concrete Materials not otherwise described herein shall be as specified in Section 03 30 00 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that all prerequisite work has been completed. Verify location and elevation of points of connection. Notify Engineer of any discrepancies.

- B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 GENERAL

- A. See Section 31 23 17 - Utility Trenching & Backfilling: Excavating for sewer system piping and structures. Inspection of bearing surfaces. Bedding & haunching. Trace Wire for Non-Metallic Piping. Initial backfill. Backfill over piping up to subgrade elevation. Warning & ID Tape. Protection of utility from disturbance and damage during backfill operation.

3.3 INSTALLATION - PIPE

- A. These General Requirements for installation of pipelines apply except where specific exception is made in the following paragraph entitled, "Special Requirements." "Also" shall mean in addition to the general requirements.
- B. Obtain required approvals before making connection to existing line. Conduct work so that there is minimum impact from any interruption of service on existing line.
- C. Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Ream pipe and tube ends and remove fins and burrs from pipe and fittings. Provide adequate means and methods for lowering sections of pipe and associated items into trenches. Do not drop or dump pipe, fittings, or any other sewer piping material. Before placing in position, clean pipe, fittings and accessories, removing scale and dirt, on inside and outside, before assembly and maintain in a clean condition.
- D. Install pipe, fittings, and accessories in accordance with ASTM D2321 (PVC) and manufacturer's instructions. Seal joints watertight.
- E. Route pipe in straight line. Lay non-pressure pipe with bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around unless a curved section is indicated on Drawings.
- F. Cut pipe accurately to measurements established at the site and work into place without springing or forcing and making proper provision for expansion and contraction of piping without stressing pipe or joints. Replace pipe or fitting that does not allow sufficient space for proper installation of joint material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted.
- G. Tolerance: Lay pipe to slope gradients indicated on Drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
- H. Ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest

solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Keep trenches free of water. At the end of each days work, close open ends of pipe temporarily with plugs, wood blocks or bulkheads.

- I. Install haunching to springline of pipe (compacted thickness) per Section 31 23 17 - Utility Trenching & Backfilling.
- J. Conduct required testing of piping system.
- K. Install trace wire continuous over top of non-metallic pipe and place cover bedding/initial backfill above springline of pipe per Section 31 23 17 - Utility Trenching & Backfilling.
- L. Connect to building sanitary plumbing outlet and municipal sewer system, septic tank & drainfield, or on-site treatment, as applicable.

3.4 SPECIAL REQUIREMENTS

- A. PVC Plastic Piping: Also conform to the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UNI B5 for joint assembly. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.5 INSTALLATION - CLEANOUTS

- A. Location/spacing: As indicated on Drawings, at all angular changes of direction and at 60 feet O.C. maximum in gravity lines not between manholes.
- B. Establish location, top elevation and pipe inverts and install wye as indicated in pipe installation above.
- C. Set vertical piping (adjusted to make ferrule or cover at proper finish grade), backfill per Section 31 23 17 - Utility Trenching & Backfilling, then set cleanout ferrule.
- D. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- E. Traffic Bearing Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the cover but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on Drawings for other dimensions. Mount cover frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 UTILITY ADJUSTMENTS

- A. Adjust new and existing structure tops affected by new work to meet proposed finish grades.
- B. Coordinate timing of adjustments to be prior to stone base applications for paved areas and prior to topsoil applications for lawn spaces.

3.7 FIELD QUALITY CONTROL

- A. The Engineer or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall provide sufficient notice of tests for Owner's representative to be present (24 hours minimum). The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in applicable section of Division 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- B. Trench, Bedding and Compaction Tests: Per Section 31 23 17 - Utility Trenching & Backfilling.
- C. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- D. Leakage Test: Test lines for leakage by low-pressure air tests. Prior to testing for leakage, place and compact haunching. When necessary to prevent pipeline movement during testing, place cover bedding/initial backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.
- E. Low-Pressure Air Test for PVC Piping: Test in accordance with UNI B6, including the allowable pressure drop. Make calculations in accordance with the Appendix to UNI B6.
- F. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.8 SCHEDULE

- A. Sanitary Gravity Line: Indicated on the Drawings as "SS". Size: as indicated on Drawings and Profiles.
- B. Cleanout: As indicated on Drawings by "SSCO".

END OF SECTION

SECTION 334100
SITE STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES (but is not limited to)

- A. Site storm drainage piping, fittings and accessories, and bedding.
- B. Drainage system from origin at inlets and/or connection to building rain leaders or downspouts to connection to municipal sewers or outfall, as applicable.
- C. Manholes, drop inlets (yard, sump or curb), detention basin structure(s).

1.2 REFERENCES

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

- A. VDOT "Road & Bridge Standards & Specifications", latest edition (hereinafter VDOT Std. ...).
- B. VDOT Memorandum LD-94(D)121.11 dated May 12, 1994 "Drainage Structure Criteria" - Polyethylene, Corrugated exterior, smooth interior (type S)

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

- C. AASHTO M-198B - (flexible butyl resin sealant (ConSeal))

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- D. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- E. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. (for use in structure risers)
- G. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- H. ASTM D698 (Standard Proctor) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- I. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- J. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

- L. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- M. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- N. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- O. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- P. ASTM F405 - Polyethylene perforated drain pipe.

1.3 DEFINITIONS

- A. Bedding: Fill placed under pipe to provide support.
- B. Haunching: Fill placed from bedding to springline of the pipe, also considered bedding, which further supports pipe in both the horizontal and vertical.
- C. Cover Bedding/Initial Backfill: Fill placed above haunching to protect pipe prior to further backfill.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Submittals.
- B. All products identified in PART 2 of this specification.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections, drainage structures, structure top elevations and invert elevations for each pipe.
- B. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.
- C. Provide As-Built Survey documentation of Storm Water Management BMP's as required by LGA.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for materials and installation of the Work of this section.

1.7 COORDINATION

- A. Coordinate the Work with termination of rain water leaders outside building, trenching, connection to foundation drainage system (as applicable), grading and erosion & sediment control/stabilization, and local governing authorities for work off-site.

PART 2 PRODUCTS

2.1 DRAINAGE PIPE MATERIALS

- A. Reinforced Concrete Pipe (RCP): VDOT Spec. Section 232.02 (a) 1. b. Reinforced concrete culvert pipe, circular, Class III (for 14' max. cover and H-20 live load); mesh reinforcement; inside nominal diameter as indicated on Drawings, standard or modified tongue-and-groove joints.
- B. Plastic Pipe (Poly-vinyl Chloride - PVC) (max. 12" diameter): VDOT Spec. Section 232.02 (g) 2. PVC Storm Drains; inside nominal diameter as indicated on Drawings.
- C. Plastic Pipe (HDPE) (12" to 36" diameter): HDPE (high density poly-ethylene) corrugated storm drain and culvert pipe, type S (smooth interior wall); inside nominal diameter as indicated on Drawings. Pipe shall conform to AASHTO M-294. Corrugated interior pipe will not be allowed.

2.2 ACCESSORIES

- A. Joints of Dissimilar Pipe: Provide standard manufactured fitting specifically for the proposed connection by same manufacturer of either type pipe or stainless steel mechanical clamp contracting ring type, neoprene ribbed gasket for positive seal (Fernco type).
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required flared end sections, tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. Filter Fabric: Per Section 31 25 13 - Erosion & Sediment Control, Silt Fence/Filter Fabric.
- D. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- E. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.
- F. Trace Wire for Non-Metallic Piping: Comply with Section 31 23 17 - Utility Trenching & Backfilling.
- G. Buried Utility Warning and Identification Tape: Comply with Section 31 23 17 - Utility Trenching & Backfilling.
- H. Hydraulic Cement Mortar and Grout: VDOT Spec. Section 218. Mortar 218.03 (a).

Grout 218 (c).

2.3 DRAINAGE STRUCTURES

- A. VDOT Standard or Modified VDOT Standard structures where indicated on the Drawings. Modified VDOT Standard structures shall conform to VDOT Standards for all work except structure shape or configuration modified per detail on Drawings. No parging will be permitted on interior walls.
- B. Manhole style access covers shall be labeled as "STORM SEWER".
- C. Gratings: Unless noted otherwise, all grates shall be cast iron material. Gratings within sidewalks, plazas, or areas that receive pedestrian traffic shall be ADA compliant.
- D. Nominal shaft diameter as required for proposed piping or as otherwise indicated on Drawings (48 inches (1200 mm) minimum for round or square, unless otherwise noted).
- E. Throat inlet lengths shall be as indicated on Drawings. Throat inlet top slope shall match that of adjacent pavement and curbing. Top units may be pre-sloped by pre-cast supplier or sloped in the field utilizing masonry.
- F. Concrete manhole taper shape and orientation (eccentric or concentric) shall be as indicated by symbol and direction on Drawings.
- G. Steps shall be per VDOT Std. ST-1 placed in line with vertical wall of eccentric tapers or as creates most desirable access in other situations. All structures over 3.5 feet deep, from top to invert out, shall be provided with steps.
- H. Flow channel shaping shall be per VDOT Std. IS-1. All structures shall be provided with shaping.
- I. Base Pad (Precast): As detailed in VDOT Standard B-1 for VDOT Std. structures, otherwise per detail on drawings.
- J. Base Pad (Cast-in-place): VDOT Std. B2 footing.
- K. Riser Joint Sealant: Provide flexible rubber compression gaskets to create permanently flexible watertight joints.

2.4 CLEANOUTS

- A. See detail on Drawings.

2.5 BEDDING AND BACKFILL MATERIALS

- A. Bedding & Haunching: See Section 31 23 17 - Utility Trenching & Backfilling.
- B. Cover Bedding/Initial Backfill (Select Backfill): See Section 31 23 17 - Utility Trenching & Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions.
- B. Verify that sizes, locations and elevations of any/all points of connection to existing or proposed work are as indicated on Drawings.
- C. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Excavate pipe trench and correct over excavation in accordance with Section 31 23 17 - Utility Trenching & Backfilling for work of this section. See Drawings for trench detail.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches (150 mm) compacted depth and compact to 95 percent. Continue until pipe springline is reached and hand excavate an accurate pipe shape to invert required. After setting pipe, where hand excavation is irregular against pipe, hand fill and tamp for an even fit tight to pipe at springline.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with VDOT Standards, applicable ASTM Standard for material and manufacturer's instructions, whichever is most stringent. Seal joints watertight.
- B. Install Detention Basin barrel in accordance with DEQ and VSM requirements including concrete cradle.
- C. Lay pipe to slope gradients noted on Drawings with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m). See Drawings for storm sewer profiles.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches (300 mm), compact to 95 percent.
- E. Refer to Section 31 23 17 - Utility Trenching & Backfilling for backfilling requirements. Do not displace or damage pipe when compacting.
- F. Make connection to all storm water collectors and receiving channel or system to

include, but are not necessarily limited to building rain leaders, downspouts, foundation drains, existing storm sewer to remain, etc. Coordinate canopy drainage to avoid canopy column foundations.

- G. Install trace wire continuous over top of non-metallic pipe. Coordinate with Section 31 23 17 - Utility Trenching & Backfilling.
- H. Install Utility Warning and Identification Tape continuous over pipe. Coordinate with Section 31 23 17 - Utility Trenching & Backfilling. See Drawings for trench detail; ID tape location.

3.5 INSTALLATION - CLEANOUTS

- A. Establish elevations and pipe inverts as indicated in pipe installation above.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Install wye per pipe installation above.
- D. Set vertical piping (adjusted to make ferrule or grate at proper finished grade), backfill per Section 31 23 17 - Utility Trenching & Backfilling, then set cleanout ferrule.
- E. Level top surface of backfill, form for the concrete collar pad (coordinating with adjacent work as necessary), and cast-in-place.
- F. Traffic Bearing Cleanout Only: Set adapter so that in the completed work the cleanout plug has 2 inches minimum to 6 inches maximum clearance beneath the lid but no deeper than flush with the concrete anchor pad. Fill from cleanout invert with VDOT Std. #26 coarse aggregate to beneath the concrete anchor pad. Wrap cleanout adapter with welder's cloth followed by aluminum flashing prior to placing concrete. See detail on drawings for other dimensions. Mount lid and frame on grout to slope and elevation of finished traffic surface. Anchor frame with 5/8" bolts to anchor pad.

3.6 INSTALLATION - DRAINAGE STRUCTURES

- A. Form bottom of excavation clean and smooth to correct subgrade elevation.
- B. Place and level a 4 inch (50 mm) base of Type A3 coarse aggregate.
- C. Set bottom riser section (doghouse or with precast base).
- D. Set pipe in and out of structure to line and grade.
- E. If not precast, form and place cast-in-place concrete base pad to pipe inverts per Drawings, providing for shaping.
- F. If precast, level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- G. Pipes shall be neatly and tightly mortared in place. Provide for required shaping.

- H. Set remaining risers and top segments to elevation indicated coordinating with adjacent work in line and grade.
- I. Mount manhole lid and frame in grout to elevation and slope of paved surface or level in lawn areas, secure top cone section to orientation (if eccentric) indicated.

3.7 FIELD QUALITY CONTROL

- A. Trench, Bedding & Backfilling Tests: Field trench inspection and compaction testing will be performed under provisions of Section 31 22 13 – Rough Grading and Section 31 23 17 - Utility Trenching & Backfilling.
- B. The Architect or other assigned Owner's representative will conduct field investigations and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Div. 1; Temporary Utilities. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.
- C. Request inspection of installed piping prior to placing cover bedding/initial backfill over pipe. Place initial backfill and reinspect.
- D. Tests for Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the other end of the segment/run of pipe. When pressure piping is used in a non-pressure line for non-pressure use, test as specified for non-pressure line.
- E. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 PROTECTION

- A. Protect finished Work under provisions of Section 31 10 00 - Site Preparation & Clearing.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.9 SCHEDULE

- A. Refer to Drawings (Profiles) for additional pipe and structure types and sizes.
- B. Storm Sewer Branch Lines: Connect inlets at various site locations with intersection of main sewer line. Size and type (HDPE) as indicated on Drawings (profiles)
- C. Detention Basin Barrel: Install using RCP with concrete cradle.

- D. Rain Leaders (RL): From 5 feet (1.5 m) beyond building wall, to municipal storm sewer; PVC; size as indicated on Drawings.

END OF SECTION

SECTION 334600
SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Complete system for the perimeter of the building through outfall / terminus connection.
 - 2. Sub-surface weep-type drainage system for building perimeter, retaining walls, and slabs-on-grade as applicable.
 - 3. Corrugated plastic (PE) pipe is prohibited.
 - 4. Filter aggregate and fabric.
 - 5. Bedding.

1.2 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM D3034 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 2. ASTM D3212 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 3. ASTM F477 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joint Gaskets.
 - 4. ASTM F758 – Standard Specification for Subdrainage Perforations.
- B. UNI-BELL
 - 1. UNI-B-1 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe Bell and Spigot Type Joints.
 - 2. UNI-B-4 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data for Information: Submit data on pipe drainage products, pipe accessories, and appurtenances. All products identified in PART 2 of this specification.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Requirements for submittals.
- B. Section 01 78 10 - Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations (highs, bends, penetrations, and connections).

PART 2 PRODUCTS

2.1 PIPE MATERIALS

- A. Depth: 6 feet or greater: Polyvinyl Chloride (PVC) Pipe: ASTM D3034 and/or UNI-BELL UNI-B-4, SDR 35 with bell and spigot joints per ASTM D3212 and/or UNI-BELL UNI-B-1 and ASTM F477 gaskets; size as indicated on Drawings (4 inch (100 mm) minimum inside diameter); with required fittings. Solid or perforated as required. Perforation pattern shall conform to ASTM F758. Perforations shall be circular, 3/16 to 1/2 inch diameter, on 3 to 3.5 inch centers, and arranged in four rows along the barrel where rows are 45 and 80 degrees either side from bottom centerline of the pipe.
- B. Use perforated pipe at subdrainage system; unperforated through sleeved walls and general conveyance.

2.2 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Materials: Fill Type A2 as specified in Section 31 05 16 – Aggregate Materials.

2.3 ACCESSORIES

- A. Filter Fabric: AASHTO M288 for subsurface drainage, Survivability Class 3, non-woven, as manufactured by TC Mirafi, Amoco Fabrics and Fibers Co., Typar Geotextiles (Reemay, Inc.). Products meeting this requirement are Mirafi 180N, Amoco ProPex 4553, or Typar 3401.
- B. Filter Cloth: (Encourages drainage) Woven geotextile fabric Manufactured by LINQ, Model #GTF 200 S.
- C. Geotextile Fabric: (Structural support) Non-woven geotextile fabric, Manufactured by LINQ Model #GTF 180 EX.
- D. Pipe Sleeve: Steel type for foundation wall penetrations, as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 31 00 – Administrative Requirements: Coordination: Verification of existing conditions before starting work.
- B. Verify trench cut or excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on shop drawings.
- C. Refer to Structural Drawings and Sections and Civil Site Drawings for subdrainage requirements and locations.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation per excavation or trenching spec as applicable.
- B. Remove large stones or other hard matter, which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place filter fabric.
- B. Place drainage pipe on fabric. Use PVC pipe where depth of fill over pipe exceeds 6 feet. Use same pipe throughout a section or loop. Separate runs may be of other materials.
- C. Lay pipe to slope gradients of 1/8 inch per foot; with maximum variation from indicated slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Place pipe with perforations facing down. Mechanically join pipe ends.
- E. Install Type A2 aggregate at sides and top of pipe. Install top cover compacted thickness of 12 inches (300 mm).
- F. Close filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 6 inch (150 mm) lifts, consolidating each lift.
- H. Refer to applicable area or trench excavation and backfill section for compaction requirements. Do not displace or damage pipe when compacting.
- I. Connect to storm sewer system or rout to surface discharge point per Drawings. Where the need for subdrainage is unnecessary use unperforated pipe (ie. extensions away from structure to sewer outlet or discharge).
- J. Coordinate the Work with connection to indicated outfall, and trenching.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Request inspection prior to placing aggregate cover over pipe.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution Requirements: Protecting installed construction.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

GEOTECHNICAL ENGINEERING REPORT

PROJECT NAME
**BEDFORD COUNTY DEPARTMENT OF
SOCIAL SERVICES & SHERIFF'S OFFICE**
BEDFORD COUNTY, VA

PROJECT NO.
20250444



PREPARED FOR
Spectrum Design, PC

DATE
April 16, 2026





April 16, 2026

Ms. Jackie Mayrosh, P.E.
Spectrum Design, PC
10 Church Avenue, SE
Plaza Suite 1
Roanoke, VA 24011

Sent via email to: jmayrosh@spectrumpc.com

Re: Geotechnical Engineering Report
Department of Social Services & Sheriff's Office Addition
1345 Falling Creek Road, Bedford VA
H&P Project #: 20250444

Dear Jackie:

Hurt & Proffitt, Inc. (H&P) has completed the subsurface investigation for the Department of Social Services & Sheriff's Office Addition project located at the referenced address in Bedford, Virginia. This report was prepared in general accordance with the approved scope of work and describes the investigative procedures, subsurface findings, and subsequent recommendations.

The investigation encompassed the following scope of services:

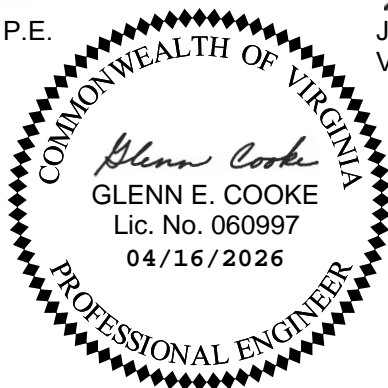
- Eleven (11) standard penetration test (SPT) borings (7 for Social Services site, 4 for Sheriff's Office site)
- Measurements for potential groundwater and borehole cave-in depths
- Laboratory testing (3 classifications, 2 expansion indices, 1 CBR, 1 standard Proctor, & 30 natural moistures)
- Geotechnical investigative report preparation

H&P appreciates the opportunity to complete this study for you. Should you have any questions in reference to the findings and results of this investigation, please do not hesitate to contact us.

Respectfully,
Hurt & Proffitt, Inc.

Glenn E. Cooke, P.E.
Project Manager

Attachments



J. Kenneth Meritt, P.G., P.E.
Vice President & Director of Geotechnical and Materials Testing



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Department of Social Services & Sheriff's Office Bedford, VA

1.0 PROJECT INFORMATION

Bedford County is planning to construct a new Social Services building and expand the existing sheriff's office. The new construction will occur at 1345 Falling Creek Road in Bedford County. The Social Services building is shown to have a building pad footprint measuring 17,500± square feet and will be located south of the existing Bedford County Community Services building and west of Falling Creek Road. The addition to the Sheriff's Office is shown to have a building pad footprint measuring 7,650± square feet and will be constructed on the north side of the existing building. According to information provided to H&P, both buildings will be supported on a basement level foundation with reinforced CMU walls. In addition to these structures, numerous civil related upgrades are also planned. These include but are not limited to parking lots, utility infrastructure, and a storm basin. The location of the new structures is depicted in Figure 1 below which consist of a Google aerial image with preliminary site plans overlain for reference.



Figure 1: Aerial Image with Preliminary Site Plan Overlay

2.0 SUMMARY

As part of this investigation, H&P reviewed U.S. Geological Survey (USGS) and geologic mapping, historical aerial imagery, and preliminary site plans for the two (2) sites. Subsurface exploration and site characterization among the proposed sites included a total of eleven (11) borings with standard penetration testing to evaluate soil stiffness and relative density. The area planned for construction of the new Social Services building consists of a grassy field with existing topography gently sloping to the south and southwest from Falling Creek Road. The area planned for construction of the addition to the Sheriff's Office is relatively flat with existing trailers present in the construction footprint. Preliminary site plans indicate a new parking lot east of the addition to tie into an existing parking area. Existing topography in the parking lot addition slopes downward forming a swale-like drainage feature. The proposed parking lot expansion is also shown to encroach upon existing septic lines, and demolition, removal, and/or relocation of existing structures and utility infrastructure will be more extensive at the Sheriff's Office site. From an earthwork perspective, a significant amount of grading is anticipated at the Social Services site, while moderate earthwork quantities are expected at the Sheriff's Office site. This includes new fill being tied into existing slopes, which should be benched and keyed in at regular intervals for improved slope stability. Recommendations for subgrade evaluation, preparation, structural fill placement, and slope construction can be found in the Earthwork & Grading Section of this report.

Boring results mostly revealed residual soil conditions with a layered sequence commonly associated with the local geology. Cohesive Elastic SILT (MH) soils were found in the upper subgrade followed by fine-grained Silt (ML) type soils that transitioned with depth to coarse-grained Silty SAND (SM) type soils. Standard penetration test (SPT) results from the residual soil profile generally indicated firm bearing conditions. Existing fill soils were encountered at 3 out of 4 boring locations at Sheriff's Office site in the upper 2 to 4 feet. Boring results indicated soft to marginal stiffness in the existing fill soil profile. Accordingly, H&P recommends that a thorough subgrade evaluation be performed across the building pad through proof-rolling to verify adequate bearing conditions are present. In the event that soft subgrade conditions are found, undercutting may be necessary. If so, H&P recommends compacted #21A/B stone be used to restore final subgrade elevations over the building pad.

Groundwater was only noted at one (1) borehole location, DSS-1 at 17.5 feet below existing grade. When compared to proposed grade, results suggest groundwater may be avoided during construction; however, groundwater levels can vary with both seasonal and topographic changes. As such, contractors should still be prepared to implement temporary dewatering measures, if needed. All borings reached their respective termination depths except for DSS-5 where auger refusal occurred at 37.3 feet below existing grade. While results are favorable, based on the local geology, it would not be uncommon to encounter rock at shallower depths in unexplored areas of the site.

Maximum anticipated service loads for columns and walls were provided by Spectrum Design, PC. The Social Services building represents the more heavily loaded structure, with column loads up to approximately 181 kips and wall loads up to 10 kips per linear foot (klf). The Sheriff's Office addition is expected to have lower loads, with maximum column loads of approximately 63 kips and wall loads up to 7 klf. Settlement calculations were performed for both proposed structures by modeling the subsurface profile using SPT boring results with foundation loads supported on spread and strip footing foundation system. Based on estimated settlements of 1-inch, an allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design. Additional information related to foundation support can be found in Section 7.2 of this report.

3.0 INVESTIGATIVE PROCEDURES

The field investigation began on March 10, 2026, and was completed on March 11, 2026. As previously mentioned, a total of eleven (11) standard penetration test (SPT) borings were done between the two (2) sites. This included seven (7) borings for the proposed Social Services development and four (4) borings for the proposed Sheriff's Office expansion. Borehole termination depths ranged from 15 to 37.3 feet below existing grades with deeper borings done in proposed building pad footprints. Borings were located in the field by measuring off of existing structures and site features. Prior to mobilization, a VA811 Miss Utility locate request was initiated. After each boring was complete, measurements for potential groundwater conditions and boring cave-in depths were collected. Borings done on March 10, 2026, were left open overnight to allow for a stabilization period. Following final readings, the holes were backfilled with soil cuttings.

The test borings were performed in accordance with generally accepted practices using a low ground pressure rubber track-mounted Mobile-B51 drill rig equipped with an Automatic Trip Hammer with an estimated efficiency of 80%. 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. The Standard Penetration Test (SPT) is conducted with a weight of 140 pounds that is freely dropped from a height of 30 inches to drive the sampler into the soil to be sampled. Continuous sampling was performed in the upper 8 feet with the quantity of applied blows required to drive the sampler four consecutive 6-inch increments recorded. Standard sampling was initiated beginning at 9 feet and continued throughout the remaining length. When each sample is collected, the quantity of applied blows required to drive the sampler three consecutive 6-inch increments is recorded. The quantity summed of the second and third increments for continuous and standard sampling equates to the SPT N-value (N_{field}) in units of blows per foot (bpf).

Generalized correlations have been empirically developed for unit weight, friction angle, cohesion, as well as other soil parameters and properties that are used as part of the geotechnical evaluation. For this project, field N-values (N_{field}) were adjusted to account for rod length, borehole diameter, and hammer efficiency (N_{60}) then normalized to account for existing vertical overburden pressures ($N_{1,60}$). The lesser of the N_{60} and the $N_{1,60}$ values were used to compute settlement. N-values referenced in this report are in terms of the field-recorded N-values (N_{field}).

• Atterberg Limit Analysis	ASTM D 4318	• CBR Analysis	VTM-8, Modified
• Sieve Analysis	ASTM D 6913	• Standard Proctor	ASTM D 698
• Natural Moisture	ASTM D 2216	• Expansion Index	ASTM D 4829

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Page 3

5.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered during the exploration are summarized in this section 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 often less distinct and can be difficult to discern. Although the logs are representative of the subsurface conditions at the locations shown, they are not necessarily indicative of subsurface conditions at other locations. Subsurface conditions identified during the investigation include cohesive, fine-grained, and coarse-grained soils. The stiffness of cohesive and fine-grained soils is described qualitatively in terms of consistency, while the density of coarse-grained soils is expressed in terms of relative density. These descriptors are a function of the SPT blow counts, as outlined in the Investigative Procedures.

5.1 Surficial Materials

The field crew noted approximately 6 inches of topsoil at most borehole locations except for SH-4 where surficial stone was encountered. When estimating the volume of removal, a thicker topsoil zone should be anticipated to ensure full removal of the organic bearing horizon.

5.2 Existing Fill

Existing or probable fill conditions were encountered at SH-1, SH-2, and SH-3 to depths reaching 2 to 4 feet below existing grades. The fill soils were classified as cohesive Elastic SILT (MH) and fine-grained SILT (ML) type soils. The consistency of the existing fill soils ranged from soft to stiff with N-values ranging from 4 to 9 bpf. Based on the boring results, these soils were marginally compacted during placement and may require undercutting.

5.3 Residual Soils

Residual soils that have weathered in place from the parent metamorphic rock underlying the site were found at all borehole locations. The residual soils were identified as cohesive Elastic SILT (MH), fine-grained Sandy SILT (ML), and coarse-grained Silty SAND (SM) type soils. When subject to SPT testing, the consistency of the cohesive and fine-grained residual soils ranged from medium-stiff to very-stiff with SPT N-values ranging from 5 to 17 bpf with most exhibiting stiff conditions. The relative density of the coarse-grained soils ranged from loose to very-dense with N-values ranging from 9 to 67 bpf with most indicating medium-dense conditions.

5.4 Partially Weathered Rock

As described in the Regional Geology Section, 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 and slow drilling, are also used to estimate the depth and layer thickness of weathered rock. The rock structure is typically preserved, and the material will crush to a sandy silt or silty sand-type soil. Based on the previously described criteria, PWR was found at 2 out of 11 borehole locations at depths ranging from 19 to 34 feet below existing grades.

5.5 Auger Refusal/Hard Rock

Hollow stem auger refusal was encountered at 1 out of 11 borehole locations, occurring at DSS-5 at a depth of approximately 37.3 feet below existing grade. When refusal occurs after reaching residual soils, it is typically an indication that the top of the bedrock surface has been reached. Based on the regional geology, depth to rock may vary across the site, and shallower bedrock conditions may be encountered in areas not explored during this investigation. The underlying bedrock is expected to consist of competent metamorphic materials, which commonly require mechanical methods such as hoe-ramming, drilling, or blasting to facilitate excavation.

5.6 Subsurface Water

Measurements for potential groundwater conditions were collected after each borehole was complete and then again prior to backfilling. The field crew also looked for other signs of potential groundwater conditions, such as very-moist/wet SPT soil samples, free moisture on the split-spoon sampler or rods, gray colored soil, and mottling. Measurable groundwater was encountered at only one location, DSS-1, at a depth of approximately 17.5 feet below existing grade. This boring was done within a low-lying portion of the site where preliminary plans indicate a proposed basin for the new Social Services site. It should be noted that groundwater levels are subject to seasonal fluctuations due to variations in precipitation, evapotranspiration, and site drainage conditions. Accordingly, while the observations from this investigation suggest that groundwater may not be encountered during construction, contractors should anticipate the potential for groundwater and be prepared to implement temporary dewatering measures, as necessary.

Table 1: Test Boring Elevation Datum

TEST BORING LOCATION	GROUND SURFACE ELEVATION	TOTAL BORING DEPTH (ft)	BOTTOM OF BORING ELEVATION	AUGER REFUSAL DEPTH (ft)	AUGER REFUSAL ELEVATION	ESTIMATED GROUNDWATER DEPTH (ft)	ESTIMATED GROUNDWATER ELEVATION	CAVE-IN DEPTH (ft)
DSS-1	923.0	25.5	897.5	—	—	17.5	905.5	19.1
DSS-2	948.0	25.5	922.5	—	—	—	—	18.2
DSS-3	946.0	25.5	920.5	—	—	—	—	20.7
DSS-4	959.0	35.5	923.5	—	—	—	—	27.0
DSS-5	963.5	37.3	926.2	37.3	926.2	—	—	27.2
DSS-6	957.0	25.5	931.5	—	—	—	—	17.8
DSS-7	962.0	25.5	936.5	—	—	—	—	17.4
SH-1	956.1	15.5	940.6	—	—	—	—	12.0
SH-2	961.5	30.0	931.5	—	—	—	—	23.5
SH-3	959.7	30.5	929.2	—	—	—	—	25.0
SH-4	960.0	25.5	934.5	—	—	—	—	19.6

6.0 LABORATORY RESULTS

All laboratory soils testing was conducted at H&P's AASHTO Resource Accredited Laboratory in Lynchburg, Virginia. The following table summarizes the results of each laboratory soils analysis and lists the location, depth range, and corresponding method for which each specimen was collected. Detailed laboratory results are appended.

Table 2: Summary of Laboratory Results

TEST BORING	DEPTH RANGE (ft)	SAMPLE METHOD	USCS SYMBOL	ATTERBERG LIMITS			#200 SIEVE (%)	NATURAL MOISTURE CONTENT (%)	STANDARD PROCTOR		CBR AT 0.1"	SWELL POTENTIAL	
				LL	PL	PI			OPTIMUM MOISTURE (%)	MAX DRY DENSITY (pcf)		CBR % SWELL	EXPANSION INDEX
DSS-2	1-6	Bulk	MH	52	48	4	84.4	23.4	—	—	—	—	56, Medium
SH-1	2-6	Bulk	ML	47	32	15	81.1	27.5	19.3	107.0	11.7	1.4, Low	—
SH-3	2-6	Bulk	ML	45	43	2	81.7	25.1	—	—	—	—	97, High

ASTM Standards

- | | | | |
|----------------------------|-------------|--------------------|-----------------|
| • Atterberg Limit Analysis | ASTM D 4318 | • CBR Analysis | VTM-8, Modified |
| • Sieve Analysis | ASTM D 6913 | • Standard Proctor | ASTM D 698 |
| • Natural Moisture | ASTM D 2216 | • Expansion Index | ASTM D 4829 |

Laboratory testing resulted in USCS soil classifications of Elastic Silt (MH) and Silt (ML). The MH soil encountered in boring DSS-2 exhibits high plasticity characteristics with a liquid limit of 52 and plasticity index of 4, along with a measured expansion index of 56, corresponding to a moderate swell potential. The ML soils encountered in borings SH-1 and SH-3 are of lower plasticity, with liquid limits ranging from 45 to 47 and plasticity indices between 2 and 15. Standard Proctor testing performed on the SH-1 sample yielded an optimum moisture content of 19.3% and a maximum dry density of 107 pcf. Please note, the natural moisture content of the Proctor sample is nearly 10% higher than the optimum moisture thus indicating the need for moisture conditioning. California Bearing Ratio (CBR) testing of this sample produced a value of 11.7, with a low swell of approximately 1.4%, indicating fair subgrade support conditions. The SH-3 sample exhibited a high expansion index of 97, indicating a high swell potential and a need for corrective action to help minimize the effects.

7.0 DESIGN & CONSTRUCTION RECOMMENDATIONS

The objective of this section is to provide geotechnical related recommendations with respect to the design and construction of the proposed new Social Services site and the proposed Sheriff's Office building addition. The recommendations were formed based on the results of the subsurface investigation and a review of preliminary site plans prepared by Spectrum Design, PC.

7.1 Earthwork & Grading

The earthwork and grading section of this report applies to subgrade evaluation, preparation, new fill placement, and slope construction. Based on existing and proposed grades, a significant amount of earthwork and grading will be needed for the Social Services site while a moderate amount is expected for the Sheriff's Office site.

Prior to earthwork and grading, contractors should identify and locate any utilities within the limits of disturbance (LoD). Removal/relocation of existing utility infrastructure is indicated on the preliminary civil plans. Following the removal of underground utilities, trenches should be properly backfilled with structural fill. Demolition and removal of existing structures should be expected prior to earthwork and grading, most notably at the Sheriff's Office site which calls for removal of existing trailers and structures, including an existing retaining wall. Furthermore, all organic bearing topsoil should be removed, including landscaping and other softscapes. Topsoil may be used to cap off "green space" but is not acceptable for structural fill applications.

Although boring results suggest groundwater may be avoided, contractors should still be prepared to implement temporary dewatering measures, if necessary.

Properly prepared subgrades should be verified via proof-roll observation by a qualified geotechnical representative. Proof-rolling is an effective subgrade evaluation method and should be done with a fully loaded quad-axle dump truck. 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, or otherwise deemed unsuitable by the geotechnical representative, should be mitigated under the direction of the representative. Potential mitigation measures include undercut and replace and/or scarify and dry. Geosynthetics, such as woven fabric and/or biaxial geogrid, may also be incorporated as a means to provide mechanical stabilization.

The on-site soils are moisture sensitive and difficult to work with during periods of wet weather, especially soils with mica. Attempts to work wet soils can result in deterioration of otherwise suitable soil conditions or deterioration of previously placed and properly compacted fill. Avoiding such deterioration, and any resulting over-excavation or replacement, is the responsibility of the grading contractor. Soils that are excessively wet or dry should not be used as fill unless properly moisture-conditioned to an acceptable range. To achieve target densities, a moisture content within +2 to -3 percentage points of the optimum is recommended. As noted previously, Proctor test results indicate the soils are approximately 10 percentage points above optimum moisture content, which suggests that drying will be necessary to achieve satisfactory compaction. Moisture conditioning of soils, in particular clay bearing 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.

Site grading should ensure positive drainage away from proposed structures, preventing ponding on the building pad or other prepared soil subgrades. A minimum slope of 2% is recommended. Subgrades should be sealed with a smooth drum roller to promote drainage and minimize infiltration prior to exposure to precipitation. In areas where additional fill is required, sealed subgrades should be scarified to improve bonding with the subsequent fill layer.

Cut and fill slopes should be constructed at a maximum inclination of 2H:1V (horizontal to vertical) unless otherwise evaluated, and building foundations should be set back a minimum of 15 feet from the crest of slopes to reduce the risk of instability or loss of support. Proper surface water management is essential for long-term performance; positive drainage should be maintained away from slope crests and faces, and concentrated runoff should not be directed over slopes without appropriate control measures. All slopes should be stabilized immediately following construction using erosion control matting or similar protection in conjunction with establishing permanent vegetative cover.

7.1.1 Structural Fill Placement

Proper placement of structural fill material improves the shear strength of the soil, minimizes settlement by reducing compressibility, and provides a uniform bearing surface to support foundations and other structures. The following are recommendations for properly placing compacted soil fill.

Compacted structural fill may be constructed using approved on-site soils that are clean and free of debris, frozen materials, organics, and other deleterious materials. If a borrow source is utilized, common acceptable soils in Lynchburg and surrounding areas generally include soils with a USCS classification of CL, ML, SC, and SM. The maximum particle size in fill zones beyond 2 feet in depth should be no larger than 3 inches in any dimension while the upper 2 feet should be limited to a maximum particle size of 1.5 inches.

The on-site cohesive Elastic SILT (MH) soils are considered suitable for the construction of a stormwater management basin. Cohesive soils typically exhibit relatively low permeability, which reduces seepage and results in slower infiltration rates and longer water retention times within the basin. For the primary spillway, H&P recommends using reinforced concrete pipe (RCP) and installing a concrete cradle along the length of the primary spillway to limit potential seepage and internal erosion. Anti-seep collars are not recommended. Excavation for the cradle should allow for a minimum of 4 inches of concrete to be placed below bottom of pipe, with the concrete placed up to the springline of the pipe to provide continuous support and seepage control. In addition, a cutoff trench should be constructed parallel to the centerline of the embankment and extended into relatively impervious material. The cutoff trench should extend to a depth of at least 4 feet below existing grade to reduce the potential for seepage beneath the embankment.

If segmental block retaining walls are incorporated into the design, the backfill within the reinforced zone should consist of a free-draining, granular soils. Cohesive and fine-grained soils, such as CL, CH, MH, and ML soils, are not suitable for use within the reinforced zone and should not be used as backfill for segmental block retaining wall construction.

Fill placement for embankments and slopes steeper than 5H:1V should be placed beginning at the toe of proposed slopes and keyed into the existing side slopes at least 12 inches in depth at regular intervals (5 feet horizontally into the existing slope for every 3 feet of vertical change in elevation). Fill slopes and embankments should be over filled beyond design grade then clipped with a track dozer to achieve design grade and ensure the outer edge and face of slope are properly compacted.

Structural fill material for building structures and load bearing elements 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 for building pads is considered to extend 15 feet in all directions beyond the building pad footprint.

Structural fill material for pavement areas, underground utilities, 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).

Structural fill material in the upper 12 inches of parking lots and roadways should be placed uniformly in horizontal layers. Each layer should have a maximum loose thickness of 8 inches and must be compacted to at least 98% of the material's maximum dry density, as determined by ASTM D 698 (Standard Proctor).

To obtain satisfactory compaction, a moisture content range of plus 2 to minus 3 percentage points from the soil's optimum moisture content, as determined by ASTM D 698 (Standard Proctor), is recommended.

Table 3: Recommended Minimum Density Test Frequencies

Location of Fill Placement	Minimum Test Frequency
Building Pads	One (1) compaction test per 2,000 square feet, per lift
Drive Aisles & Parking Lot	One (1) compaction test per 2,500 square feet, per lift
Slopes & Embankments	One (1) compaction test per 3,000 square feet, per lift
Utilities	One (1) compaction test per 50 lineal feet, per lift

A minimum of three (3) compaction tests are recommended per lift, regardless of the area or length.

7.2 Foundations & Slabs-on-Grade

This section presents geotechnical recommendations related to foundation support, interior slabs-on-grade, lateral earth pressures, and seismic site classification for the new proposed Social Services building and the proposed Sheriff's Office addition. These recommendations are based on the results of the subsurface investigation, laboratory test results, commonly accepted industry settlement criteria, finished floor elevations shown on the preliminary civil plans, and maximum service loads provided for each proposed building structure (Table 4 below).

Table 4: Maximum Service Loads

STRUCTURE TYPE	MAXIMUM COLUMN LOADS (kips)	MAXIMUM WALL LOADS (klf)
Social Services	181	10
Sheriff's Office	63	7

7.2.1 Foundation Support

Settlement computations were done by modeling an idealized subsurface profile for the building using corrected SPT N-values with foundation loads supported on a conventional strip and spread footing foundation system. Based on estimated total settlements of 1-inch and assuming the recommendations in this report are adhered to, an allowable soil bearing capacity of 2,000 psf may be used for foundation design of the Social Services building and the addition to the Sheriff's Office. All footing subgrades should be tested by a qualified geotechnical representative using a dynamic cone penetrometer (DCP) to ensure the allowable soil bearing capacity is achieved.

Footing excavations should provide firm, stable bearing surfaces free of loose, wet, or otherwise disturbed soils. Subgrades should be compacted using manually operated vibratory equipment to densify any loosened material resulting from excavation. Concrete should be placed on the same day as the bearing surface is prepared to prevent softening from overnight rain or other precipitation.

Based on the expansion index test results at both sites, H&P recommends that exterior footings for the proposed Social Services building and the Sheriff's Office addition be placed at a minimum depth of 36 inches below final exterior grade. Minimum embedment depths for interior footings may be established at the discretion of the structural engineer of record. Foundation construction for the Sheriff's Office addition is not expected to require underpinning of the existing structure. Preliminary plans indicate that the proposed lower-level finished floor elevation (FFE) for the addition generally corresponds to the existing lower-level FFE, thereby minimizing the need for excavation below existing foundation bearing elevations. If field conditions or final design details differ from those shown on the preliminary plans, H&P should be notified to evaluate the conditions and provide recommendations regarding the potential need for underpinning.

7.2.2 Interior Grade Slabs

Interior floor slabs may be constructed as slab-on-grade bearing on properly prepared subgrades. Where moisture-sensitive floor coverings are anticipated, the aggregate beneath the slab should consist of an open-graded material, such as VDOT No. 57 stone, to provide a capillary break and facilitate drainage, thereby reducing the potential for moisture migration into the slab. In these applications, it is important that the open-graded layer remains free-draining; positive drainage should be maintained and conditions that could allow water to accumulate within the stone layer should be avoided or addressed through the use of underdrains, if necessary. A vapor retarder is recommended beneath all interior slab-on-grade areas to limit upward migration of moisture vapor, which can adversely affect slab performance and floor coverings. The vapor retarder should be installed directly beneath the slab in accordance with American Concrete Institute guidance (e.g., ACI 302.1R), with seams overlapped and sealed, and all penetrations properly taped. Care should be taken during construction to prevent damage to the membrane, and any punctures should be repaired prior to concrete placement.

Based on on-site soil conditions and CBR results, a subgrade modulus (k) of 120 pounds per cubic inch (pci) may be used for the design of subgrades prepared and verified per the recommendations described in this report. Prior to stone placement, the soil subgrade should be proof-rolled in accordance with the recommendations described in this report. ACI considers a proof-roll the most effective means of evaluating soil subgrades for grade slabs. This is particularly important in the proposed Sheriff's Office addition pad due to existing fill soils being present.

7.2.4 Site Class Seismic Rating

A site class seismic rating was determined using the average standard penetration resistance procedure. For this approach, subsurface data to a depth of 100 feet is needed to determine the average standard penetration resistance. While none of the borings reached a depth of 100 feet, apparent hard rock was found at DSS-5 at 37.3 feet below existing grade. Based on our experience with the local geology, it is reasonable to assume that the bedrock profile continues throughout the remaining 100-foot length. Based on the results of the average standard penetration resistance procedure, a site class seismic rating of "D" may be used for structural design. Seismic design parameters for both sites were obtained from the USGS/ASCE 7-22 seismic hazard mapping tool and are attached as Appendix H.

7.2.3 Lateral Earth Pressures

The earth pressure parameters presented in Table 5 were developed based on Rankine earth pressure theory and are applicable for evaluating lateral earth pressures on cast-in-place concrete and masonry walls with level backfill conditions. Cohesive soils, including clay bearing materials, are not recommended for use within the backfill zone due to poor drainage characteristics. Backfill soils should consist of free-draining, granular materials capable of satisfying the parameters outlined in the approved soils column. More favorable design parameters, including increased friction angle and reduced lateral earth pressures, may be achieved through the use of VDOT #57 stone. If the parameters for #57 stone are used for design, the #57 stone backfill should extend from the heel of the footing upward along a plane inclined at approximately 65 degrees from horizontal. This configuration should be clearly depicted in the structural design documents.

Table 5: Lateral Earth Pressures

Material	#57 Stone	Approved Soils
Active (K_A)	0.22	0.36
At-Rest (K_O)	0.36	0.53
Passive (K_P)	1.38	1.38
Moist Unit Weight – (γ_m)	110 pcf	130 pcf
Cohesion (C)	0 psf	0 psf
Angle of Internal Friction (ϕ')	40°	28°
Coefficient of Friction ^A	0.35	0.35

A. To be used for evaluating sliding between a concrete retaining wall foundation and properly prepared soil subgrade.

The soils on the passive side of the wall are expected to consist of in-place soils. For this reason, the passive earth pressure coefficient corresponds to in-place soils. The recommended unit weight for soils on the passive side is 110 pcf. Furthermore, in current geotechnical practice, it is industry standard to reduce the theoretical passive earth pressure coefficient (K_P) for wall design to account for the amount of movement that is required to fully mobilize passive resistance and account for potential disturbance of the passive zone. The passive earth pressure coefficients shown in the table above have already been reduced by one-half.

H&P's recommendations assume that a constantly functioning drainage system is installed behind the wall to prevent the build-up of hydrostatic pressures. The drainage system should include a minimum 12-inch-wide chimney drainage layer of #57 stone with a minimum 4-inch perforated pipe at the base of the wall to convey water to a proper discharge outlet. A geo-textile non-woven filter fabric should be installed to provide separation between the #57 stone and soil with the intent of preventing fines from migrating into the stone.

The effect of surcharge loads should be added to the recommended earth pressures to determine the total applied lateral stress subjected on the wall. This includes earth pressures induced by compaction equipment. The use of heavy equipment adjacent to retaining walls can result in increased lateral earth pressures and subsequent excess wall movements. Lightweight hand-operated equipment should be used for compaction. Heavy equipment should not be utilized within the construction zone measured at a 45-degree angle from the base of the wall structure.

7.3 Flexible & Rigid Pavement Recommendations

The objective of this section is to provide flexible and rigid pavement recommendations for the proposed project. H&P evaluated various flexible pavement sections using VDOT's *Pavement Design Guide for Subdivision and Secondary Roads in Virginia*, which primarily considers average daily traffic (ADT) in units of vehicles per day (vpd) and subgrade strength characterized by the California Bearing Ratio (CBR) test. Laboratory CBR testing was performed on a single bulk soil sample in accordance with Virginia Test Method 8 (VTM-8), yielding a design CBR value of 7.8. In terms of projected traffic volumes, H&P assumed an average daily traffic volume of approximately 800 vpd for the Social Services site and 400 vpd for the Sheriff's Office site. Based on these assumptions, the standard-duty pavement sections presented in Table 6 are recommended for each respective site. Should actual or projected traffic volumes differ from these assumptions, H&P should be given the opportunity to review and, if necessary, revise the recommendations provided herein.

Please note, at VDOT right-of-way tie-ins, it may be required that the pavement section matches the existing pavement, thus resulting in a heavier pavement section than shown in Table 6 below.

Table 6: Flexible Asphalt Pavement Section

Standard Duty Pavement Section		Social Services (inches)	Sheriff's Office (inches)
Surface	SM-9.5D	2	2
Intermediate	IM-19	—	—
Base	BM-25	3	3
Subbase	VDOT size 21A/B	8	6
Total Thickness		13	11

Current preliminary plans indicate a light-duty pavement section consisting of 2 inches of SM-9.5 surface mix over 8 inches of compacted aggregate base. While the light-duty pavement section may be used for designated parking areas, it should be recognized that this section will not provide the same service life as thicker pavement sections incorporating an asphalt base layer as indicated in Table 6 above. Parking spaces are subject to sustained static loading, which promotes creep and permanent deformation in the underlying materials, as well as increased exposure to petroleum products (e.g., oil and fuel leaks) that can soften and degrade the asphalt binder over time. In addition, the absence of an asphalt base layer reduces the structural capacity and load distribution characteristics of the pavement system, making it more susceptible to rutting, cracking, and localized distress. Accordingly, the use of this light-duty section is predicated on the implementation of a routine pavement maintenance program, including periodic inspections, crack sealing, and timely repairs, to help mitigate deterioration and extend the service life of the pavement.

A proof-roll of the prepared soil subgrade should be performed prior to placement of the base course stone to verify firm uniform bearing conditions are present. Proof-rolling should be conducted in general accordance with the procedures outlined in the Earthwork and Grading Section of this report, using a fully loaded tandem-axle dump truck or similar equipment, and should be observed by a qualified geotechnical representative.

Following acceptance of the subgrade, crushed stone base material should be placed in controlled lifts and compacted to at least 98 percent of the material's maximum dry density as determined by the standard Proctor test (ASTM D698), or in accordance with an approved roller pattern that demonstrates equivalent compactive effort. Field density testing should be performed on the base stone to verify that compaction requirements have been achieved. Additionally, density testing of the flexible pavement sections should be conducted in accordance with applicable VDOT specifications or project specifications to verify compliance with contract documents.

**8.0 LIMITATIONS**

This report has been prepared for the exclusive use of Spectrum Design, PC and their authorized representatives for the Department of Social Services and Sheriff's Office project located in Bedford, 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 industry-standard 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 construction, it will be necessary to reevaluate our conclusions and recommendations based upon on-site observations of the conditions.

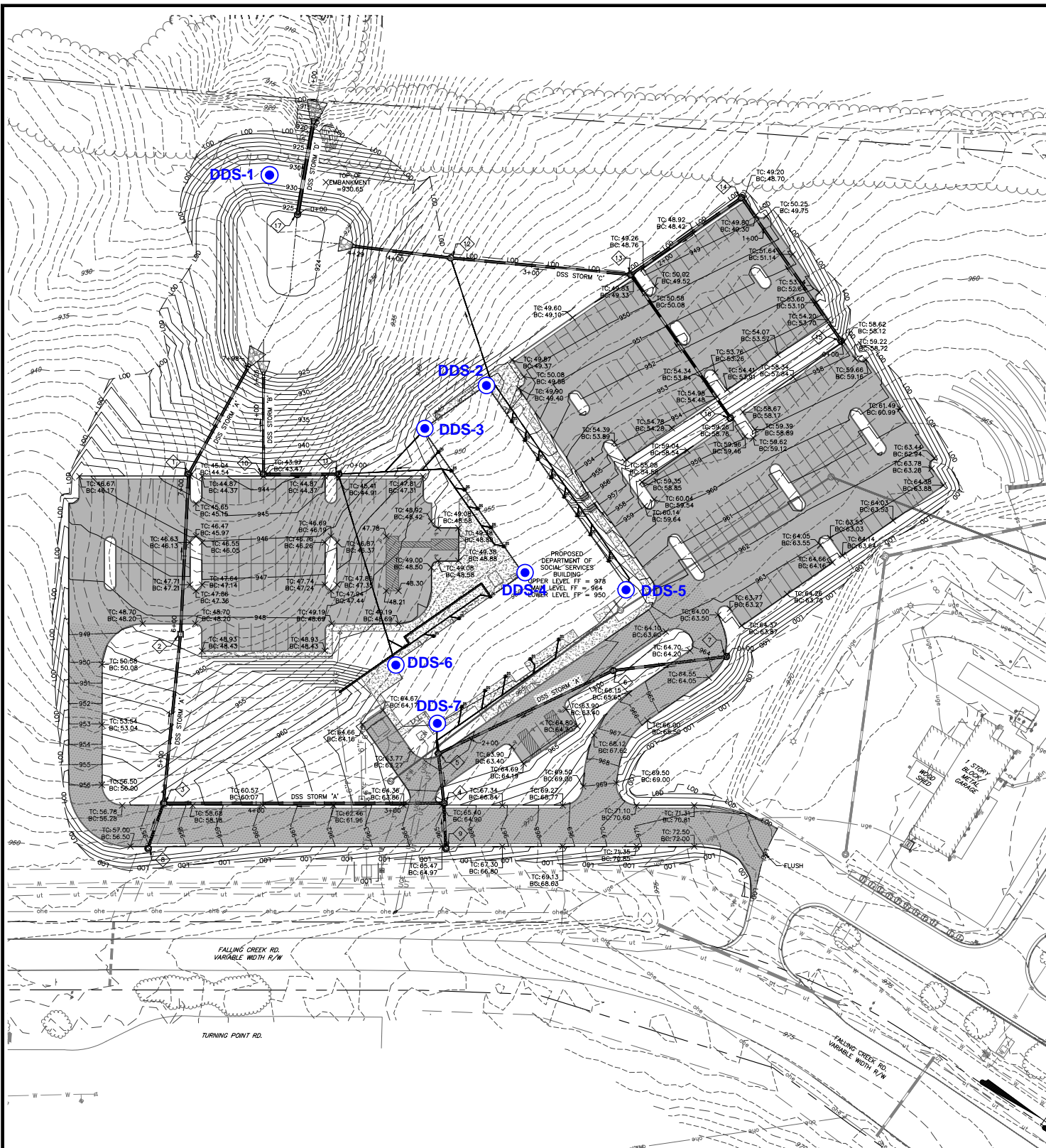
In the event that changes are made to the location of the proposed structure(s) or other planned improvements, the recommendations presented in this report shall not be considered valid unless the changes are reviewed by our firm and the conclusions of this report are modified and/or verified in writing. We should also be given the opportunity to review the complete construction plans. This review is generally necessary to ensure the recommendations and comments provided herein have been understood and properly implemented.



Appendix A

Test Boring Location Map

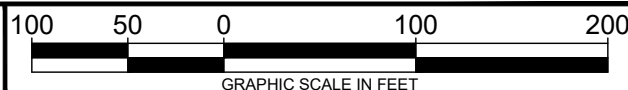
THIS SHEET IS INTENDED TO BE REPRODUCED AT 8.5"X11" REPRODUCTION OF THIS SHEET AT A DIFFERENT SIZE THAN INTENDED SHALL VOID THE SCALE SHOWN ON THE SHEET.



PROJECT #: 20250444
DATE: 03/10/2026

LAT: 37°18'42.3"N
LONG: 79°30'19.0"W

APPENDIX: A
SHEET: 1 of 2



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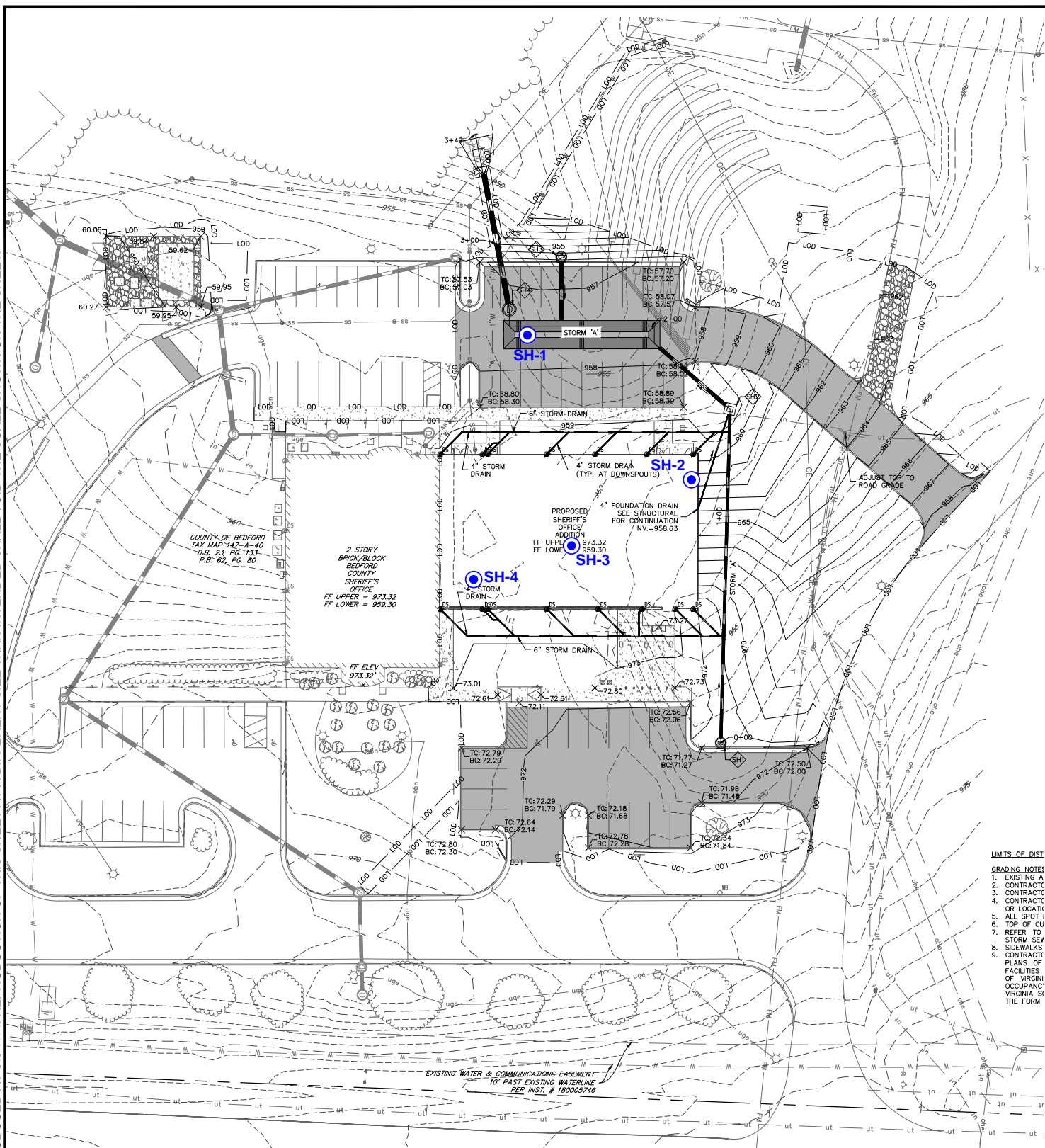


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TEST BORING LOCATION PLAN FOR BEDFORD COUNTY SOCIAL SERVICES BUILDING BEDFORD COUNTY, VA

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PROJECT #: 20250444
DATE: 03/10/2026

LAT: 37°18'42.3"N
LONG: 79°30'19.0"W

APPENDIX: A
SHEET: 2 of 2



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TEST BORING LOCATION PLAN FOR BEDFORD COUNTY SHERIFF'S OFFICE ADDITION BEDFORD COUNTY, VA



Appendix B
Test Boring Logs

LOG OF BORING DSS-1

SHEET 1 of 1



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 http://www.HandP.com

CLIENT: Spectrum Design, PC
 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS:	
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/10/2026.
							LL	PL	PI		
SURFACE ELEVATION: 923.0											
BORING DEPTH (ft): 25.5											
PROPOSED SUBGRADE ELEVATION:											
GROUNDWATER DEPTH AT COMPLETION (ft): 19.0											
GROUNDWATER DEPTH AFTER 24 HRS (ft): 17.5											
DESCRIPTION OF STRATUM											
920		1	1								6 inches of Topsoil
		2	3	5							RESIDUUM: Medium Stiff, Red ELASTIC SILT (MH), moist Stiff, with Sand, contains mica
		3	10								
		4	2								
		5	6	14	33						
		6	8								
		7	11								
		8	3	15	27						Stiff, Reddish Brown Sandy SILT (ML), contains mica moist
		9	6								
		10	11								
11	3										
12	6	14									
13	8										
14	10										
15	3										
16	6	13	24								
17	7										
18	11										
19	12										
20	13										
21	14										
22	15	3									
23	6	13	22								
24	7										
25	11										
26	12										
27	13										
28	14										
29	15										
30	16										
31	17										
32	18										
33	19										
34	20	3									
35	6	13									
36	7										
37	11										
38	12										
39	13										
40	14										
41	15										
42	16										
43	17										
44	18										
45	19										
46	20										
47	21										
48	22										
49	23										
50	24										
51	25	2									
52	4	9									
53	5										
Boring Terminated at 25.5 feet											

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:

Cave-in at 19.1 feet

LOG OF BORING DSS-2







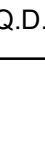
SHEET 1 of 1



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CLIENT: Spectrum Design, PC
 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA					DRILLING DETAILS: Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.	
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D.	N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS				MINUS NO. 200 SIEVE (%)
								LL	PL	PI		
DESCRIPTION OF STRATUM												
945		1	2	6								6 inches of Topsoil
		4	6									
		2	2									
		3	6									
		4	13									
940		5	6	15								Orangish Brown, Sandy, contains mica
		9	8									
		12	9									
		17	12									
		23	52									
935		6	7	17								Very Stiff, Reddish Brown Sandy SILT (ML), contains mica and
		10	10									
		18	18									
		25	25									
		28	28									
930		7	10	28								Medium Dense, Brown fine Silty SAND (SM), contains mica, moist
		8	18									
		12	25									
		26	26									
		41	41									
925		9	12	67								Very Dense
		10	26									
		11	41									
		12	12									
		14	8									
920		13	14	31								Dense
		15	17									
		16	17									
		17	17									
		18	17									
915		19	12	48								Grayish Brown
		20	20									
		21	28									
		22	28									
		23	28									
910		24	15	40								Boring Terminated at 25.5 feet
		25	19									
		21	21									

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 18.2 feet

LOG OF BORING DSS-3

SHEET 1 of 1



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CLIENT: Spectrum Design, PC
PROJECT: Bedford SS & Sheriff's Office
LOCATION: 1345 Falling Creek Rd
Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS:	
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.	
						LL	PL	PI			
SURFACE ELEVATION: 946.0											
BORING DEPTH (ft): 25.5											
PROPOSED SUBGRADE ELEVATION:											
GROUNDWATER DEPTH AT COMPLETION (ft):											
GROUNDWATER DEPTH AFTER 24 HRS (ft):											
DESCRIPTION OF STRATUM											
945		1	3	6						6 inches of Tospoil	
		2	6							RESIDUUM: Medium Dense, Reddish Brown Sandy ELASTIC SILT (MH), contains quartz rock fragments, moist	
		3	5	14						Stiff	
		4	10								
		5	3	13	24					Stiff, Reddish Brown Sandy SILT (ML), contains mica, moist	
940		6	4								
		7	7	15							
		8	11								
		9	3								
		10	6	13	27						
935		11	7								
		12									
		13									
		14	3								
		15	5	11	19					Medium Dense, Olive Grayish Brown fine Silty SAND (SM), contains mica, moist	
930		16	6								
		17									
		18									
		19	4								
		20	5	12							
925		21	7								
		22									
		23									
		24	3								
		25	6	13							
		7							Boring Terminated at 25.5 feet		

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 20.7 feet

LOG OF BORING DSS-4

SHEET 1 of 2



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PROJECT: Bedford SS & Sheriff's Office
LOCATION: 1345 Falling Creek Rd
Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS:	
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.	
						LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI		SURFACE ELEVATION: 959.0	
										BORING DEPTH (ft): 35.5	
										PROPOSED SUBGRADE ELEVATION:	
										GROUNDWATER DEPTH AT COMPLETION (ft):	
										GROUNDWATER DEPTH AFTER 24 HRS (ft):	
										DESCRIPTION OF STRATUM	
										6 inches of Topsoil	
955		1	2	6						RESIDUUM: Medium Stiff, Red ELASTIC SILT (MH), moist Stiff	
		2	4								
		3	2	11	28						
		4	8								
		5	5	12	24					Stiff, Reddish Brown Sandy SILT (ML), contains mica, moist	
		6	7								
		7	2	10							
		8	6								
950		9	3								
		10	6	13	12						
		11	7								
		12									
945		14	4							Medium Dense, Olive Grayish Brown fine Silty SAND (SM), contains micaceous, moist	
		15	5	11	11						
		16	6								
		17									
940		19	3								
		20	5	12	13						
		21	7								
		22									
935		24	5								
		25	7	15	12						
		26	8								
		27									
930		29	7								
		30	11	22							

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 27 feet

LOG OF BORING DSS-4

SHEET 2 of 2



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 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS:
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)
							LL	PL	PI	
925		31	X	11						
		32								
		33								
		34	X	8						
		35	X	10 13	23					

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 27 feet

LOG OF BORING DSS-5

SHEET 1 of 2



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 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS: Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTEBERG LIMITS			MINUS NO. 200 SIEVE (%)	
						LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI		
DESCRIPTION OF STRATUM										
										SURFACE ELEVATION: 963.5 BORING DEPTH (ft): 37.3 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 27.2 feet

LOG OF BORING DSS-5

SHEET 2 of 2



Hurt & Proffitt, Inc.
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 Telephone: (434) 847-7796
 Fax: (434) 847-0047
 http://www.HandP.com

CLIENT: Spectrum Design, PC
 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS:			
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.		
							LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX				
												LL	PL
SURFACE ELEVATION: 963.5													
BORING DEPTH (ft): 37.3													
PROPOSED SUBGRADE ELEVATION:													
GROUNDWATER DEPTH AT COMPLETION (ft):													
GROUNDWATER DEPTH AFTER 24 HRS (ft):													
DESCRIPTION OF STRATUM													
930		31	X	12							Medium Dense, Reddish Brown fine to coarse Silty SAND (SM), contains mica, moist(continued)		
		32											
		33											
		34	X	50/3"	50/3"							34.0	Partially Weathered Rock: Grayish Brown Silty SAND (SM), micaceous, moist
		35											
		36											
		37									37.3	Auger Refusal on Apparent Rock at 37.3 feet	

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 27.2 feet

LOG OF BORING DSS-6






SHEET 1 of 1



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 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS: Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	
						LL	PL	PI		
SURFACE ELEVATION: 957.0										
BORING DEPTH (ft): 25.5										
PROPOSED SUBGRADE ELEVATION:										
GROUNDWATER DEPTH AT COMPLETION (ft):										
GROUNDWATER DEPTH AFTER 24 HRS (ft):										
DESCRIPTION OF STRATUM										
955		1	3	7	28					6 inches of Topsoil
		2	6							
		3	8							
		4	9							
950		5	6	15	23					Sandy, contains mica
		6	9							
		7	6							
		8	6							
945		9	3	10	18					Reddish Brown Sandy SILT (ML), contains mica, moist
		10	5							
		11	6							
		12								
940		13	5	16						Medium Dense, Reddish Brown fine Silty SAND (SM), micaceous, moist
		14	7							
		15	9							
		16								
935		17		13						Boring Terminated at 25.5 feet
		18								
		19	5							
		20	6							
		21	7	13						
		22								
		23		13						
		24	5							
		25	6							
			7							

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:

Cave-in at 17.8 feet

LOG OF BORING DSS-7







SHEET 1 of 1



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CLIENT: Spectrum Design, PC
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LOCATION: 1345 Falling Creek Rd
Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA				LAB DATA				DRILLING DETAILS: Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/11/2026.
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTEBERG LIMITS			MINUS NO. 200 SIEVE (%)		
					LL	PL	PI			
SURFACE ELEVATION: 962.0 BORING DEPTH (ft): 25.5 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):										
DESCRIPTION OF STRATUM										
960		1	2	5					6 inches of Topsoil	
		2	3						RESIDUUM: Medium Dense, Red ELASTIC SILT (MH), moist Stiff	
		3	6							
		4	9							
955		5	2	27					Medium Dense, Reddish Brown fine to coarse Silty SAND (SM), contains quartz rock fragments, moist	
		6	22							
		7	18							
		8	12							
950		9	50/5"	50/5"					contains elastic silt layer, (blow counts may not be indicative of soils conditions)	
		10	5							
		11	6							
		12	8							
945		13		14					Stiff, Reddish Brown Sandy SILT (ML), contains mica, moist	
		14	7							
		15	9							
		16	10							
940		17		19					Olive Grayish Brown fine Silty SAND (SM), micaceous, moist	
		18								
		19	5							
		20	8							
		21	10	18						
		22								
		23								
		24	5							
		25	10	22						
			12							
									Boring Terminated at 25.5 feet	

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 17.4 feet




LOG OF BORING SH-1

SHEET 1 of 1



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 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444

ELEVATION (feet)	SOIL SYMBOL	FIELD DATA				LAB DATA				DRILLING DETAILS:	
		DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/10/2026.
							LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI		
SURFACE ELEVATION: 956.1											
BORING DEPTH (ft): 15.5											
PROPOSED SUBGRADE ELEVATION:											
GROUNDWATER DEPTH AT COMPLETION (ft):											
GROUNDWATER DEPTH AFTER 24 HRS (ft):											
DESCRIPTION OF STRATUM											
955		1	2	2	4						6 inches of Topsoil
		2	2	3							FILL: Soft, Reddish Brown ELASTIC SILT (MH), moist 2.0
		3	1	2	4						PROBABLE FILL: Soft, Red ELASTIC SILT (MH), moist
		4	2	2							4.0
		5	2	3	5						RESIDUUM: Medium Stiff, Reddish Brown SILT (ML) with Sand, moist
950		6	2	4		27	47	32	15	81	6.0
		7	2	5	11						Stiff, Reddish Brown Sandy SILT (ML), contains mica, moist
		8	10								
		9	3	6	14	22					
945		10	8								
		11									
		12									
		13									14.0
		14	3	4	9						Loose, Olive Yellow Brown fine Silty SAND (SM), contains mica, moist
		15	5								15.5
											Boring Terminated at 15.5 feet

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 12 feet

LOG OF BORING SH-2

SHEET 1 of 2



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		FIELD DATA			LAB DATA				DRILLING DETAILS:	
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTEBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/10/2026.	
					LL	PL	PI		SURFACE ELEVATION: 961.5 BORING DEPTH (ft): 30.0 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):	
DESCRIPTION OF STRATUM										
<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 23.5 feet

LOG OF BORING SH-2

SHEET 2 of 2



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FIELD DATA		LAB DATA				DRILLING DETAILS:			
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							LL		
									Boring Terminated at 30.0 feet

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 23.5 feet



SHEET 1 of 2

SHEET 1 of 2



CLIENT: Spectrum Design, PC
PROJECT: Bedford SS & Sheriff's Office
LOCATION: 1345 Falling Creek Rd
Bedford County, Virginia

PROJECT NO. 20250444

		FIELD DATA			LAB DATA					DRILLING DETAILS:
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	SURFACE ELEVATION: 959.7 BORING DEPTH (ft): 30.5 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):
						LL	PL	PI		
						LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
DESCRIPTION OF STRATUM										
		1	3	9						PROBABLE FILL: Stiff, Red SILT (ML) with Sand, contains crushed stone, moist
		2	4							RESIDUUM: Stiff, Red ELASTIC SILT (MH), moist
		3	3	11						
		4	4							
955		5	5	12	23					
		6	2		25	45	43	2	82	Medium Stiff, Reddish Brown Sandy SILT (ML), contains mica, moist
		7	3	8						micaceous
		8	5							
950		9	4	13						Medium Dense, Olive Brown fine Silty SAND (SM), contains mica, moist
		10	5							
		11	8							
		12								
		13								
945		14	4	12						
		15	6							
		16	6							
		17								
		18								
940		19	3	10						Loose, Olive Grayish Brown
		20	4							
		21	6							
		22								
		23								
935		24	3	9						
		25	4							
		26	5							
		27								
		28								
930		29	3							Medium Dense
		30	4	12						

N - Standard Penetration Test Resistance (ASTM D 1586)
R.Q.D. - Rock Quality Designation

NOTES:
Cave-in at 25 feet

LOG OF BORING SH-3

SHEET 2 of 2



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 Lynchburg, VA 24501
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 Fax: (434) 847-0047
<http://www.HandP.com>

CLIENT: Spectrum Design, PC
 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444

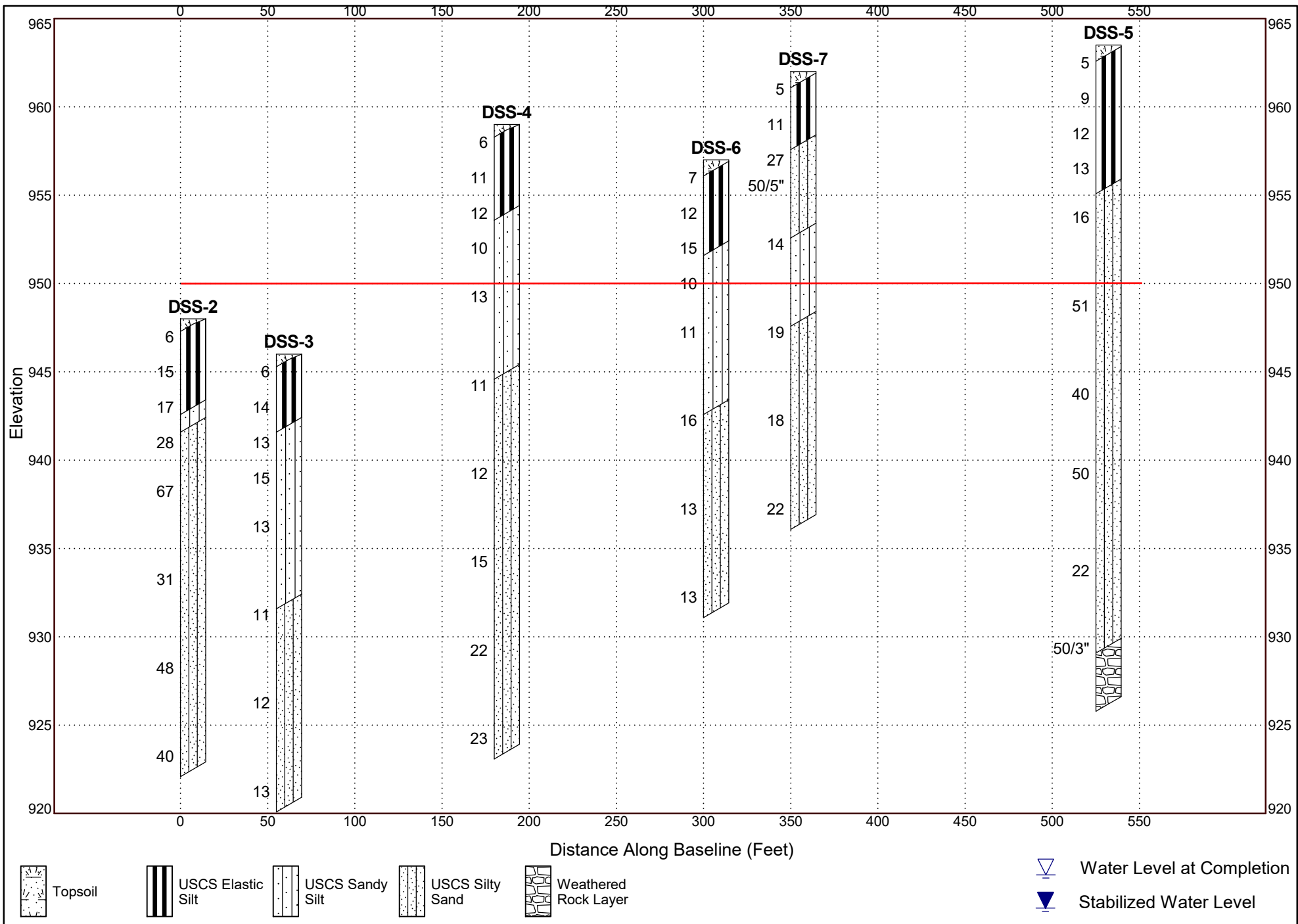
		FIELD DATA			LAB DATA				DRILLING DETAILS:		
ELEVATION (feet)	SOIL SYMBOL	DEPTH (feet)	SAMPLES	BLOW COUNT	PERCENT RECOVERY / R.Q.D. N-value	MOISTURE CONTENT (%)	ATTERBERG LIMITS			MINUS NO. 200 SIEVE (%)	Drilled by D. Cash using B51 Mobile and Continuous Flight Hollow Stem Augers. Boring completed 3/10/2026. SURFACE ELEVATION: 959.7 BORING DEPTH (ft): 30.5 PROPOSED SUBGRADE ELEVATION: GROUNDWATER DEPTH AT COMPLETION (ft): GROUNDWATER DEPTH AFTER 24 HRS (ft):
							LL	PL	PI		
			X	8							DESCRIPTION OF STRATUM Boring Terminated at 30.5 feet

N - Standard Penetration Test Resistance (ASTM D 1586)
 R.Q.D. - Rock Quality Designation

NOTES:
 Cave-in at 25 feet



Appendix C
Boring Profile Diagrams



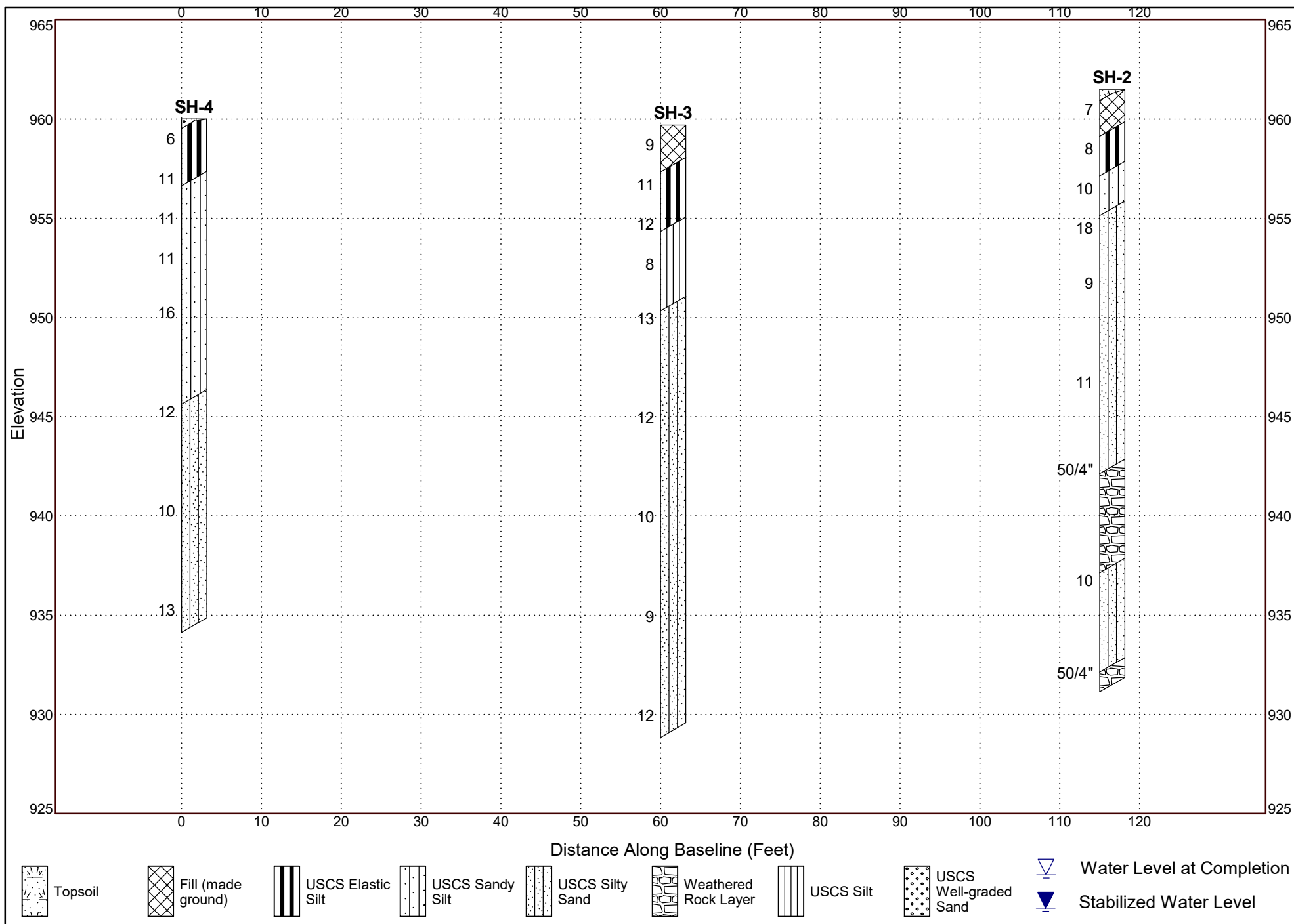
BORING PROFILE DIAGRAM
SOCIAL SERVICES BLDG

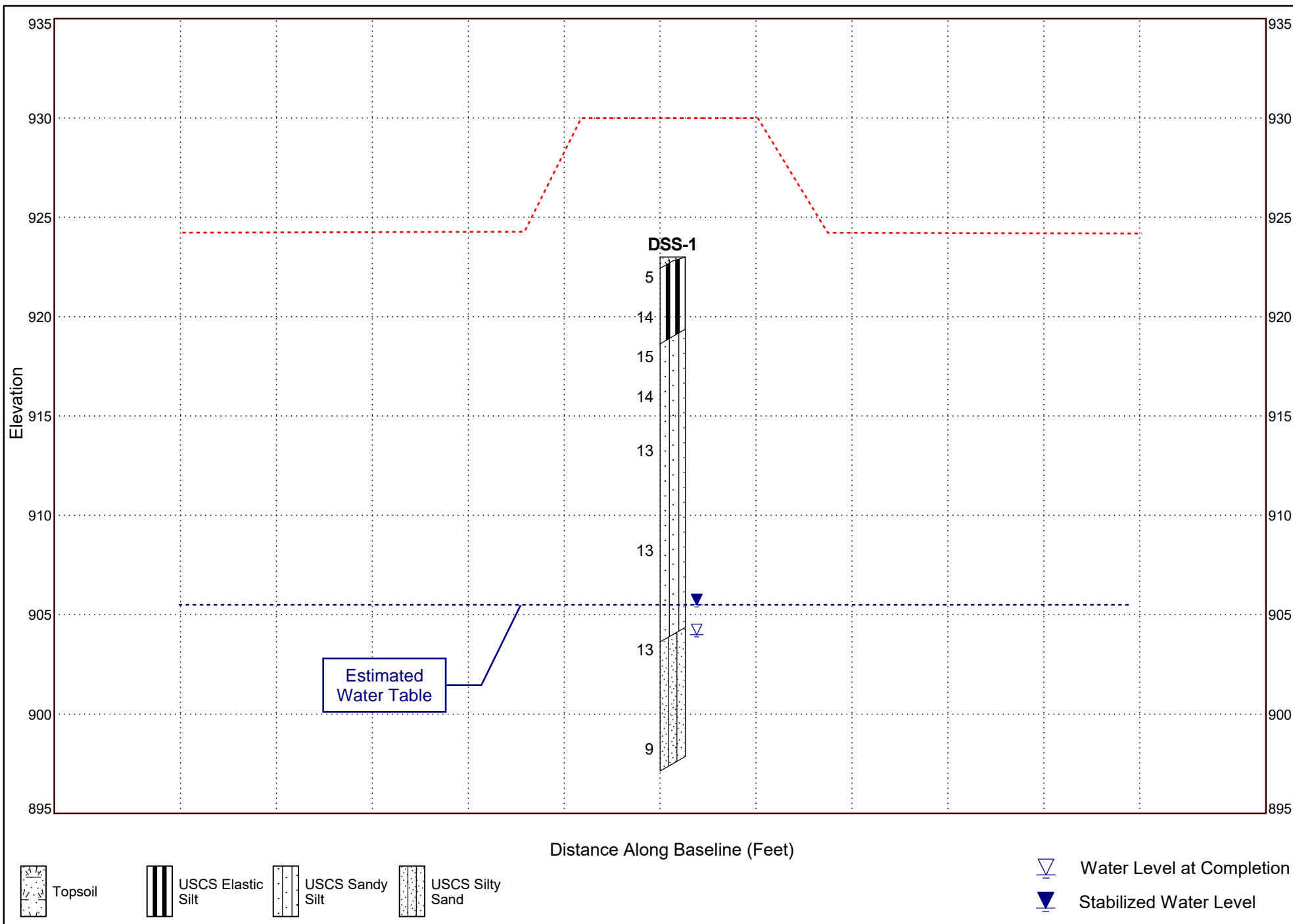
Bedford SS & Sheriff's Office
 1345 Falling Creek Rd

H&P PROJECT #
 20250444

DATE
 Apr 2026





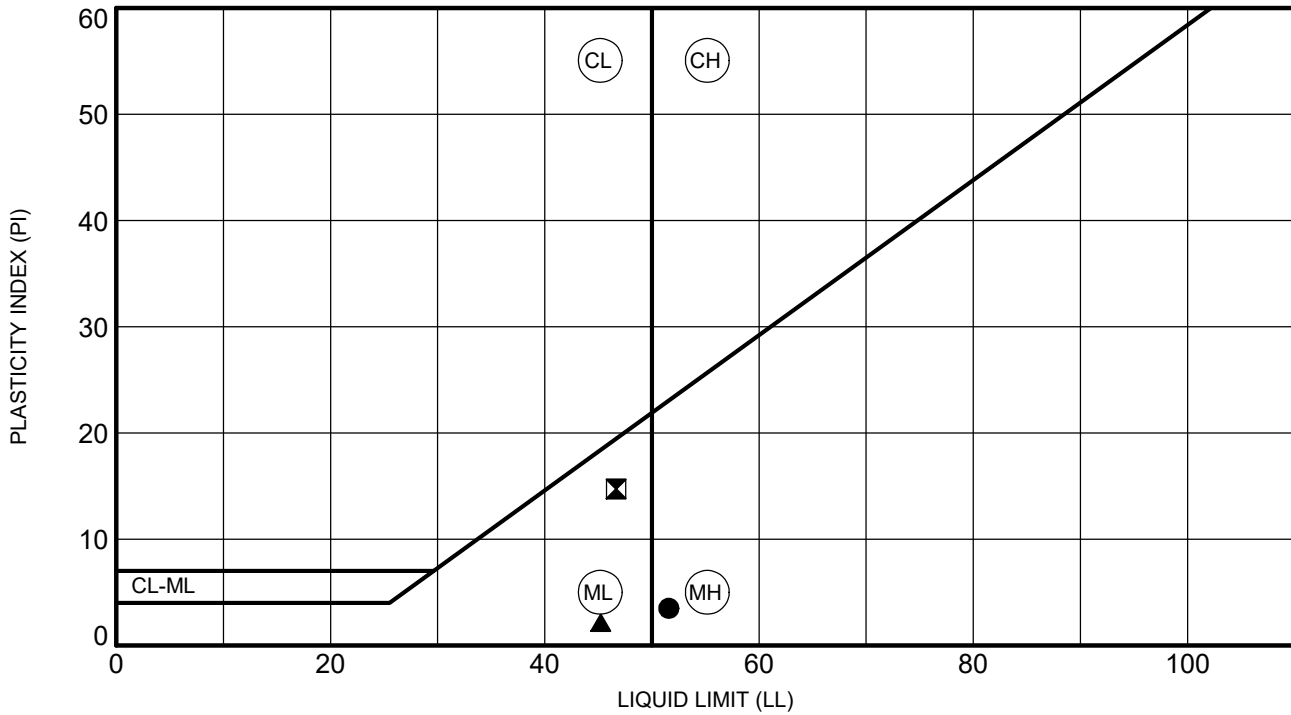




Appendix D

Atterberg Limits & Sieve Analysis Results

ATTERBERG LIMITS' RESULTS

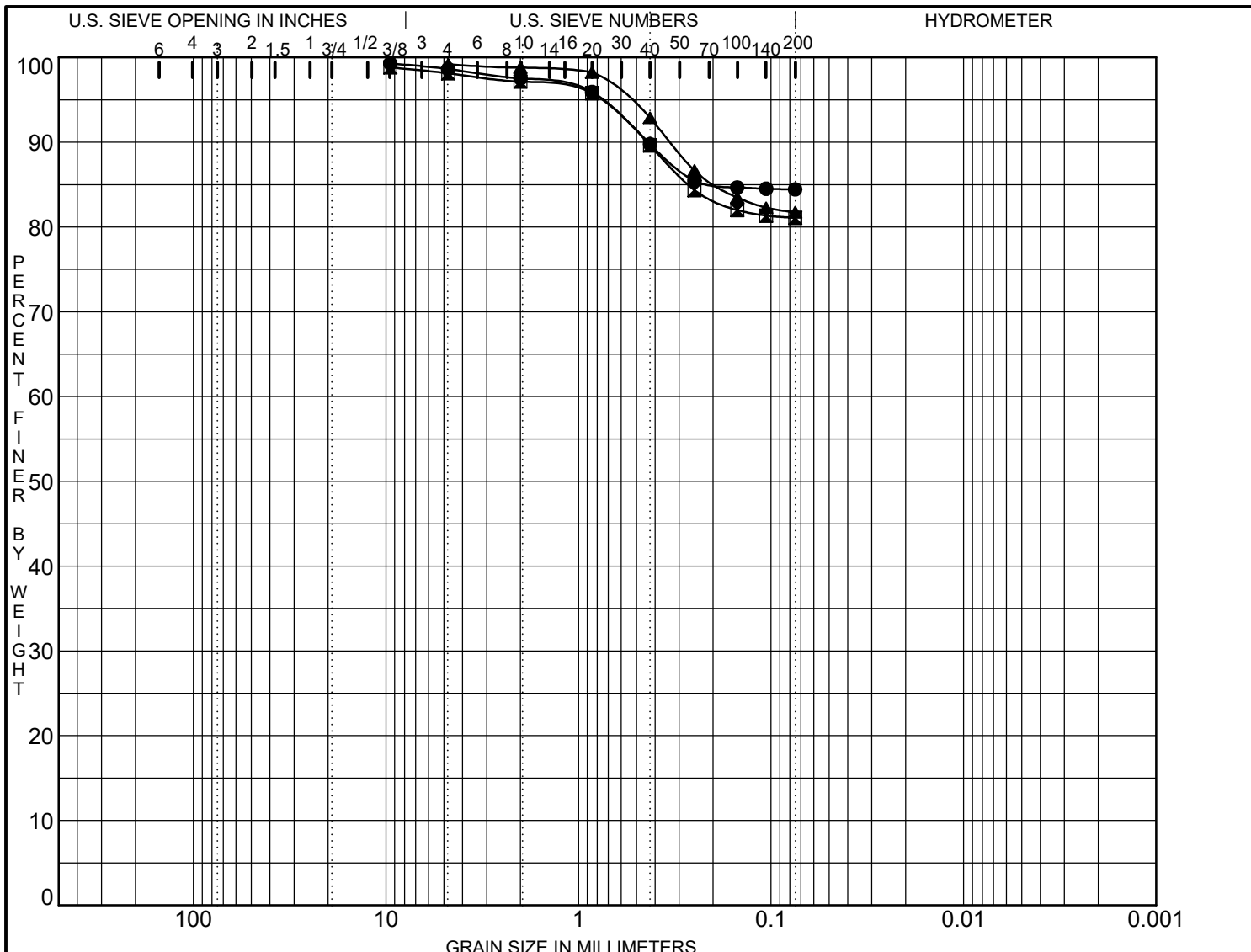


Specimen Identification	LL	PL	PI	Fines	Classification
● DSS-2 6.0	52	48	4	84.4	Yellowish Red ELASTIC SILT with SAND (MH)
⊠ SH-1 6.0	47	32	15	81.1	Reddish Brown SILT with SAND (ML)
▲ SH-3 6.0	45	43	2	81.7	Reddish Brown SILT with SAND (ML)



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 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					MC%	LL	PL	PI
● DSS-2 6.0	Yellowish Red ELASTIC SILT with SAND (MH)					23.4	52	48	4
☒ SH-1 6.0	Reddish Brown SILT with SAND (ML)					27.5	47	32	15
▲ SH-3 6.0	Reddish Brown SILT with SAND (ML)					25.1	45	43	2

Specimen Identification	D100	D60	D30	D10	Cc	Cu	%Gravel	%Sand	%Silt	%Clay
● DSS-2 6.0	9.50						0.7	14.2	84.4	
☒ SH-1 6.0	9.50						0.7	17.0	81.1	
▲ SH-3 6.0	4.75						0.0	17.4	81.7	

SIEVE 20250444.GPJ 4/14/26



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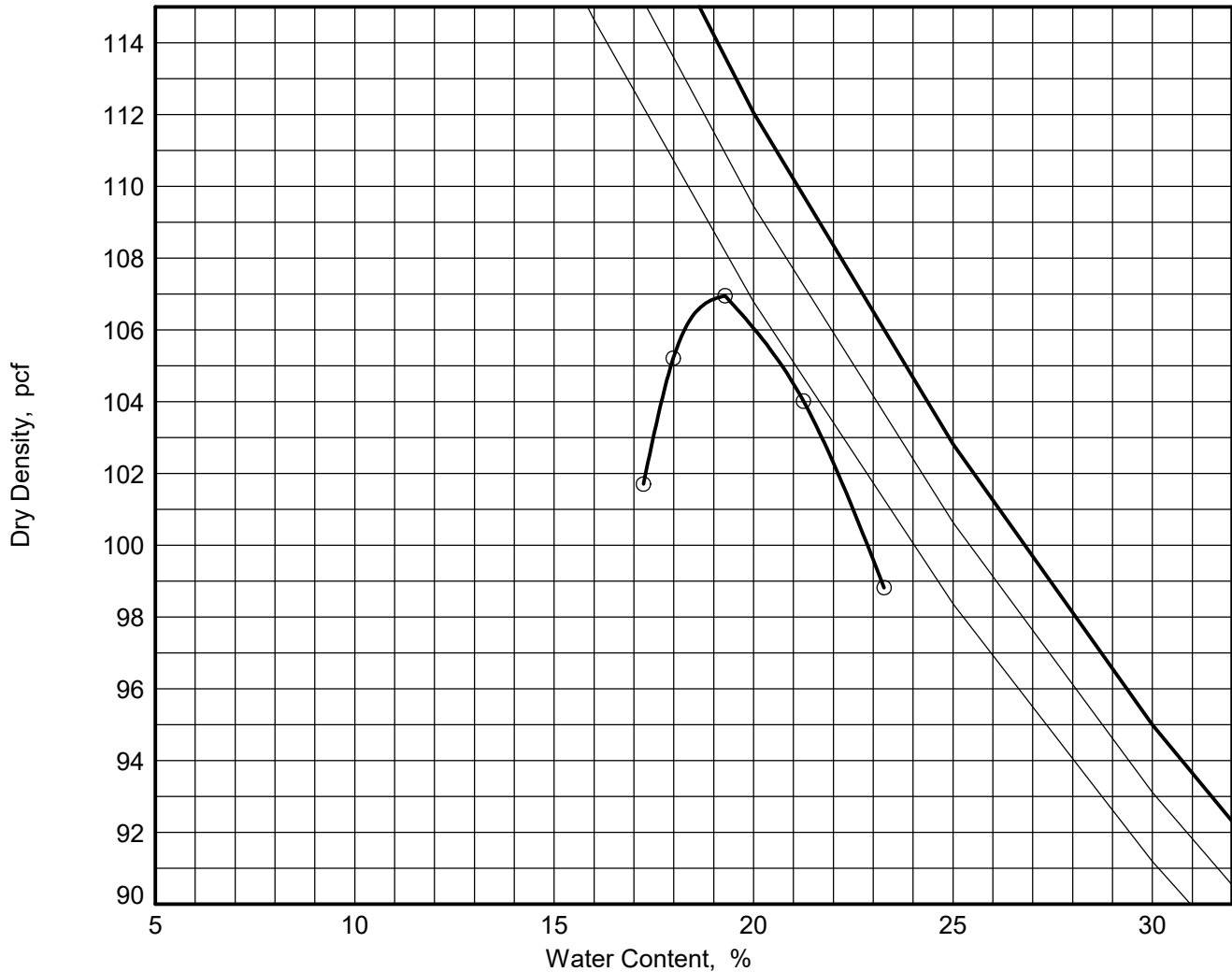
CLIENT: Spectrum Design, PC
 PROJECT: Bedford SS & Sheriff's Office
 LOCATION: 1345 Falling Creek Rd
 Bedford County, Virginia
 PROJECT NO. 20250444



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: SH-1		
Reddish Brown SILT with SAND (ML)				A-7-5(11)	Maximum Dry Density = 107.0 pcf Optimum Moisture = 19.3 %		
Natural Moisture	Specific Gravity	Liquid Limit	Plasticity Index	% < 3/4 in.	% < 3/8 in.	% < No. 4	% < No. 200
27.5		47	15	100.0	98.8	98.1	81.1

Sampled by D. Cash March 10, 2026

Sample location: Bedford

Proposed use:



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<http://www.HandP.com>

CLIENT: Spectrum Design, PC
PROJECT: Bedford SS & Sheriff's Office
LOCATION: 1345 Falling Creek Rd
Bedford County, Virginia
PROJECT NO. 20250444



Appendix F

CBR Results



Project Name: Bedford SS & Sheriff's Office

Project #: 20250444

Location: 1345 Falling Creek Rd, Bedford VA

Date: March 27, 2026

Sample ID: SH-01

California Bearing Ratio Computations (VTM-8 Modified)

Soil Description: Reddish Brown SILT with SAND (ML)

Liquid Limit: 47

Plasticity Index: 15

Minus 200 (%): 81.1

Proctor Density (pcf): 107.0

Optimum Moisture (%): 19.3

Computed Weight of Compacted Soil in CBR Mold

0.075	x	107.0	=	8.03	lbs, weight of dry soil
453.6	x	8.03	=	3640	grams, weight of dry soil
3640	x	1.193	=	4343	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	11424	11518	grams
Wt. of mold	7100	7100	grams
Wt. of wet soil (S_w)	4324	4418	grams
Moisture content (w)	19.2	25.1	percent
Wt. of dry soil	3628	3532	grams

Compaction Effort

3 Layers
56 Blows/Layer

Mold ID: # 26

Percent Density Obtained: 99.7 % 95.7 %

Density (D) = $S_w / (V \times (1+w) \times 453.6)$, w is expressed as a decimal

$D_s = \frac{106.6}{102.4}$

$V_s = \frac{0.0750}{0.0760}$

w = $\frac{0.192}{0.251}$

$D_i = \frac{102.4}{102.4}$

$V_i = \frac{0.0760}{0.0760}$

w = $\frac{0.251}{0.251}$

V_i = resulting volume after soak, $V_i = [(1/4\pi d^2) \times (h_o + \Delta h)] \times 0.0005787$

Computation of Swell

Reading before immersion 0.257 points

Reading after immersion 0.320 points

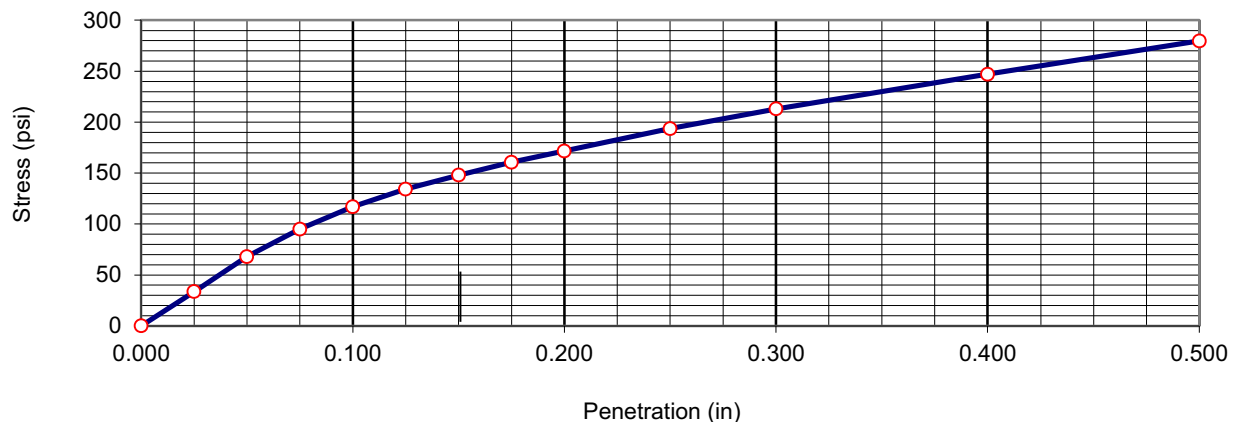
Amount of Swell 0.063 points

% Swell = 1.37

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	34	68	95	117	134	148	161	172	194	213	247	280
Total load after 4 day soak	0	101	204	285	351	403	444	482	515	581	639	741	839

Load-Penetration Curve



CBR Value (0.1") = 11.7 %

CBR Value (0.2") = 11.4 %



Appendix G
Expansion Index Results



EXPANSION INDEX REPORT

ASTM D 4829

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ENGINEERING • SURVEYING • LAND DEVELOPMENT • ENVIRONMENTAL
GEOTECHNICAL • CONSTRUCTION TESTING & INSPECTION • CULTURAL RESOURCES

PROJECT: Bedford Social Services & Sheriff's Office DATE SAMPLED: 3/10/26
CLIENT: Spectrum Design, PC DATE TESTED: 3/25/26
H&P REPRESENTATIVE: K. Meritt PROJECT NO: 20250444

SAMPLE LOCATION: DSS-2 (Depth 2-6 FT)

SOIL DESCRIPTION: Yellowish Red ELASTIC SILT with SAND (MH)

MOISTURE/DENSITY DETERMINATION

Wt. of Empty Dish (g)	76.78
Wt. of Dish & Wet Soil (g)	168.95
Wt. of Dish & Dry Soil (g)	157.31
% Moisture	14.5
Wt. of Mold (g)	365.71
Wt. of Mold & Wet Soil (g)	728.57
Wt. of Wet Soil (g)	362.86
Ring Volume (ft ³)	0.00725
Wet Density (lbs/ft ³)	110.3
Dry Density (lbs/ft ³)	96.4

Field Moisture = 23.4%

% SATURATION CALCULATIONS

Specific Gravity	2.7
% Moisture	14.5
Dry Density (lbs/ft ³)	96.4
(S), % Saturation	52.2

EXPANSION INDEX CALCULATIONS

Initial Height (H ₁ = 1.000 in)	Dial reading (in)	Time (hr:min)	Date
D ₁	0.0001	1:12 PM	3/25/26
D ₂	0.0412	1:40 PM	3/25/26
D ₃	0.0421	2:41 PM	3/25/26
D ₄	0.0432	3:50 PM	3/25/26
D ₅	0.0550	8:30 AM	3/26/26
D ₆	0.0553	1:05 PM	3/26/26
Expansion Index (EI _{meas})	55	Final Moisture %	34.0%
Expansion Index (EI ₅₀)	56	% +4 Material	<5 %
Potential Expansion	Medium		



EXPANSION INDEX REPORT

ASTM D 4829

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PROJECT: Bedford Social Services & Sheriff's Office DATE SAMPLED: 3/11/26
CLIENT: Spectrum Design, PC DATE TESTED: 3/31/26
H&P REPRESENTATIVE: K. Meritt PROJECT NO: 20250444

SAMPLE LOCATION: SH-3 (Depth 2-6 FT)

SOIL DESCRIPTION: Reddish Brown SILT with SAND (ML)

MOISTURE/DENSITY DETERMINATION

Wt. of Empty Dish (g)	77.91
Wt. of Dish & Wet Soil (g)	168.47
Wt. of Dish & Dry Soil (g)	156.60
% Moisture	15.1
Wt. of Mold (g)	365.65
Wt. of Mold & Wet Soil (g)	719.00
Wt. of Wet Soil (g)	353.35
Ring Volume (ft ³)	0.00725
Wet Density (lbs/ft ³)	107.4
Dry Density (lbs/ft ³)	93.4

Field Moisture = 25.1%

% SATURATION CALCULATIONS

Specific Gravity	2.7
% Moisture	15.1
Dry Density (lbs/ft ³)	93.4
(S), % Saturation	50.6

EXPANSION INDEX CALCULATIONS

Initial Height (H ₁ = 1.000 in)	Dial reading (in)	Time (hr:min)	Date
D ₁	0.0001	1:20 PM	3/31/26
D ₂	0.0691	1:35 PM	3/31/26
D ₃	0.0934	3:15 PM	3/31/26
D ₄	0.0939	4:05 PM	3/31/26
D ₅	0.0964	9:00 AM	4/1/26
D ₆	0.0966	12:00 PM	4/1/26
Expansion Index (EI _{meas})	97	Final Moisture %	34.0%
Expansion Index (EI ₅₀)	96	% +4 Material	<5 %
Potential Expansion	High		



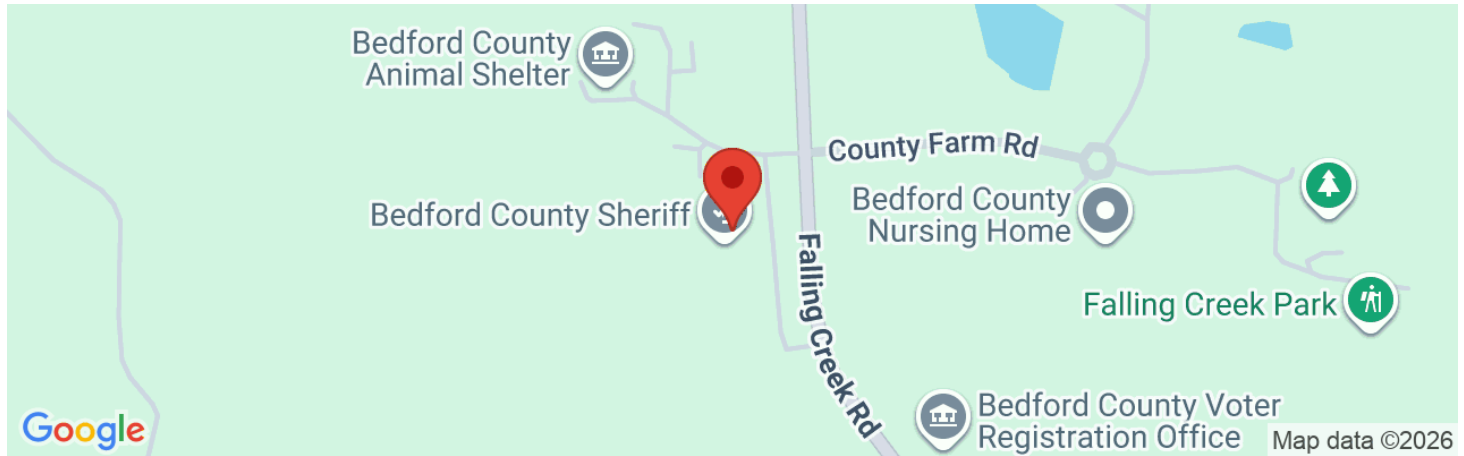
Appendix H

Seismic Design Parameters



1345 Falling Creek Rd, Bedford, VA 24523, USA

Latitude, Longitude: 37.3115506, -79.5051865



Date	4/15/2026, 11:14:52 AM
Design Code Reference Document	ASCE7-22
Risk Category	II
Site Class	D

Type	Value	Description (Data)
S_S	0.19	The MCE_R spectral response acceleration at 0.2 seconds for Site Class BC, in units of g.
S_1	0.064	The MCE_R spectral response acceleration at 1 second for Site Class BC, in units of g.
S_{MS}	0.24	$S_{MS} = 1.5 \times S_{DS}$, the Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration for short periods (of the two-period spectrum) and the user-specified Site Class.
S_{M1}	0.14	$S_{M1} = 1.5 \times S_{D1}$, the MCE_R spectral response acceleration for 1 second (of the two-period spectrum) and the user-specified Site Class.
S_{DS}	0.16	The design spectral response acceleration for short periods (of the two-period spectrum) and the user-specified Site Class, in units of g.
S_{D1}	0.091	The design spectral response acceleration for 1 second (of the two-period spectrum) and the user-specified Site Class, in units of g

Type	Value	Description (Data Contd.)
SDC	B	Seismic design category
PGA_M	0.1	PGA_M , the Geometric-Mean Maximum Considered Earthquake (MCE_G) peak ground acceleration for the user-specified Site Class, in units of g
T_S	0.574	$T_S = S_{D1}/S_{DS}$, in seconds, for construction of the two-period design spectrum
T_0	0.115	$T_0 = 0.2 \times T_S$, in seconds, for construction of the two-period design response spectrum
T_L	12	T_L , the long-period transition period, in seconds, for construction of the two-period design response spectrum

Type	Value	Description (Underlying Data and Metadata)
PGA_{uh}	0.1	Probabilistic uniform-hazard (2%-in-50-years), geometric-mean peak ground acceleration, in units of g.
PGA_{84th}		Deterministic 84th-percentile, geometric-mean peak ground acceleration (without deterministic lower limit), in units of g.
V_{S30}	260	The shear-wave velocity used for the user-specified Site Class, in units of m/s
Spatial Interpolation Method	linearloglinear	Identifier for spatial interpolation method used to obtain values for location of interest from underlying gridded values: "linearloglinear" for bilinear of natural logarithm of values.
PGA_{dFloor}	0.53	Deterministic lower limit peak ground acceleration (PGA_G) for the user-specified Site Class, in units of g.
riskTargetedSpectrum		Probabilistic risk-targeted, maximum direction response spectrum (for 1%-in-50-years collapse risk)
eightyFourthSpectrum		Deterministic 84 th -percentile, maximum-direction response spectrum (without deterministic lower limit)